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AN APPRAISAL OF THE ERROR IN COGNITIVE MAPS; THE EXAMPLE OF PERCEPTION LOCATION OF SKIERS IN ALBERTA

by

© BRYONY WALMSLEY

A THESIS

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GEOGRAPHY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled AN APPRAISAL OF THE ERROR IN COGNITIVE MAPS; THE EXAMPLE OF PERCEPTION LOCATION OF SKIERS IN ALBERTA submitted by BRYONY WALMSLEY in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE.

Abstract

The mental maps of downhill skiers from Edmonton and Calgary are examined in order to determine which factors most affect perceptual error. Centrographic techniques and a bidimensional program are used to measure the amount of distortion in the maps. Whether a person has ever visited a resort is found to be the most important contributory factor to the amount of error. Six other variables are identified: frequency of visit, length of residency in the origin city, sex, skiing experience, perceived attractiveness and preference. The relative effects of different variables and the origin city on perceptual error are examined; it was found that the differences between the variables conformed to the hypotheses more than differences in the origin city, which were not as strong as originally expected. The effect of boundaries on perception is briefly discussed and it is found that distortional stress is concentrated along the boundary zones. A model is developed to synthesize the interrelationships between behaviour and the identified variables.

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First I would like to thank John Honsaker for answering all my questions and for his invaluable technical help. I also very much appreciate the advice given to me by both the cartographic and photographic staffs. As far as the actual thesis is concerned, it would never have arrived in this form without the expert typing and endless patience of Jean-Pierre Lebourgeois. My thanks are extended to Jean-Claude Muller for his encouragement and supervision of the first draft. My final thanks go to Ken Fairbairn, for not only consenting to act as Chairman at the last minute, but also for his help and guidance in the compilation of the final draft.

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1. INTRODUCTION

1.1 Background

We base our decisions on the environment as we perceive it, not necessarily as it is, but although our decisions are based on perceptions, our resulting behaviour is in the real world. These simple axioms are fundamental to the study of perception and behaviour.

The concept of perception initially belonged in the domain of psychology, but more recently, the concept has been applied to a range of sociological and geographical problems.[1] Within the latter two disciplines, the definition of perception has been generally confined to that of 'social perception', as opposed to the more pysiological approach of psychologists. Social perception was found by geographers to be an amenable tool with which to further their understanding of man's behaviour in the environment. This type of study however is of a fairly recent nature, since it was not until the advent of a work by Boulding in 1956 entitled The Image that geographers first started to take an interest in perception.[2] In this work, Boulding provided the initial theoretical basis for the concept of the 'image' as being the mediating link between man and the environment; he proposed that people possess images in their heads built up

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[1]W. Bevan, (1958). "Perception: Evolution of a Concept." Psychological Review, 65 (1), 34-53, gives a detailed description of the historical evolution of the status of perception in psychological research.

[2]K.E. Boulding, (1956). The Image. Ann Arbor, University of Michigan Press.

from such factors as past experience, subjective knowledge and values.[3] Lynch's The Image of the City and the Sprouts' work both reinforced the concept of the image and they used empirical evidence to support their contentions that perception and behaviour are interrelated.[4] Since then, the concept of perception has found many diverse geographical applications, such as in studies concerning the human response to hazards, carrying capacity in recreation research, place preference analysis in the context of both migration and recreation studies and movement patterns in cities.[5]

1.2 Mental Maps

Much of the research on the topic of movement patterns in cities incorporates the notion that people order the undifferentiated mass of spatial information assimilated daily, into 'maps' to help them find their way around, through and over the environment. These maps are known

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[3] ibid.

[4] K. Lynch, (1960). The Image of the City. Cambridge, Mass.: M.I.T. Press. H. Sprout and M. Sprout, (1956). Man-Milieu Hypothesis in the Context of International Politics. Princeton, New Jersey.

[5] See for example: I. Burton, W. Kates and G.F. White, (1978). The Environment as Hazard. Oxford University Press Inc., New York, on hazards perception; D. Mercer, (1971). "The Role of Perception on the Recreation Experience: a Review and Discussion." Journal of Leisure Research, 3 (4), 261-276, on the concept of carrying capacity in a recreational context; S.E. White, (1978). "Mental Map Variability: a Migration Modelling Problem." Annals of Regional Science, 12 (3), 89-97; and T. Lee, (1970). "Perceived Distance as a Function of Direction in a City." Environment and Behaviour, 2, 40-51.

synonymously as 'mental' or 'cognitive' maps. Although we may believe our perceptions of the environment to be true, sometimes they are erroneous, leading to distortions and a non-Euclidean spatial construct. For example, distance in mental maps is usually not composed of equal units; it is relational rather than positional and varies over space, that is, places may preserve their spatial relationships, but be incorrectly positioned in the geographical sense.[6]

The reasons why mental maps are erroneous are both numerous and complex. The real world presents stimuli which are either recorded in the mind or ignored. How the mind responds to these stimuli depends on factors such as learning, experience, culture, physiology and social background, which may all combine to form an erroneous image of varying degrees. Take for example a journey to work; the initial journey taken through new surroundings will offer no familiar landmarks and due to ignorance, that particular distance in the mental map may be over- or under-estimated in relation to the actual distance between the points. The more frequently a person follows a particular route, the more familiar it will become and the mental map may become less erroneous as the perceived distance approximates better to the cartesian distance. The mental map therefore changes over time due primarily to experience and the learning process.

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[6]P. Wight, (1975). "Cognitive Mapping and Space Perception." The Albertan Geographer, 11, 20.

On first consideration, mental maps may appear to be unique, and impossible to study for that very reason. However it has been found that certain features of mental maps may be shared within a particular group of people, but may vary between given groups.[7] The journey to work example can be used to illustrate this point. It has been seen how various stimuli along a particular route combine in a person's mind to allow him to perceive that specific journey. Another person taking a similar route by the same mode of transport may possess a mental map with a number of similarities concerning slow, dangerous or fast sections of the route and consequently will give roughly the same estimation of distance. Therefore a group of car owners may share a similar image. On the other hand, a person travelling by another mode of transport, such as a bicycle, could have a very different map of the same route and an altogether conflicting estimation of the distance; the mental image therefore is not shared between the groups of car owners and bicyclists.

Mental or cognitive mapping then, can be defined as being an abstraction covering the cognitive abilities which enable one to collect organise, store, recall and manipulate

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[7] See for example the discussion in D. Lowenthal, (1961). "Geography, Experience and Imagination: Towards a Geographical Epistemology." Annals of the Association of American Geographers, 51 (3), 241-60; E.T Hall, (1966). The Hidden Dimension. Doubleday and Co. Inc., New York; and R. Maurer and J.C. Baxter, (1972). "Images of the Neighbourhood and City among Black-, Anglo-, and Mexican-American Children." Environment and Behaviour, 4, 351-88.

information about the spatial environment.[8]

1.3 Aim of the Thesis

Mental maps are not necessarily confined to distance estimation or even an urban context. They have been used to discover a city's imageability, regional preferences, socially dangerous or appealing sections of a city, shape perception of countries and location perception. This thesis examines the latter application of mental maps, that of locational perception.

It has been pointed out that mental maps are all erroneous, but that they change through time and often become more accurate with respect to the real world with the acquisition of experience and familiarity. In addition mental maps may share common elements within a given subject group, which are not shared between groups. The main aim of the thesis is to explain the error found in the perception of a series of locations in terms of within-group similarities and between-group differences. The groups will be based on behavioural data obtained from a subject population through the medium of a questionnaire. By undertaking this study, it is hoped that the interrelationship between perception and behaviour will be better understood.

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[8] R.M. Downs and D. Stea, (1977). Maps in Minds - Reflections on Cognitive Mapping. Harper and Row Publishers.

1.4 Sample Choice and Study Area

Downhill skiers were chosen as the sample population; the mental maps were obtained by asking them to plot where they perceived a series of well-known Rocky Mountain ski resorts to be located in relation to their city of residence (Edmonton or Calgary)(Figure 1). Downhill skiing was selected for a number of theoretical and practical reasons:

1. It involves mapping perceptions at a regional scale rather than at the urban scale which most researchers have used.
2. It involves a number of important factors critical to people's perceptions: resort attractiveness, time-distance thresholds, preferences and boundaries.
3. It compares the 'perceptual range' of subjects, since the distances from Edmonton to the ski areas are much greater than those from Calgary.
4. A socially homogeneous subject group may be identified allowing skiing variables to be identified in relation to perceptual error, rather than social variables.
5. The cities of Edmonton and Calgary were chosen as the origins for two reasons: they are the nearest large centres of population for all the selected ski resorts and 70 per cent of all skiers to the Albertan resorts emanate from Edmonton and Calgary.[9]

The final reason is of a practical nature. Downhill skiing

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[9] Alberta Business Development and Tourism, (1976). 1976 Ski Industry Evaluation Study.

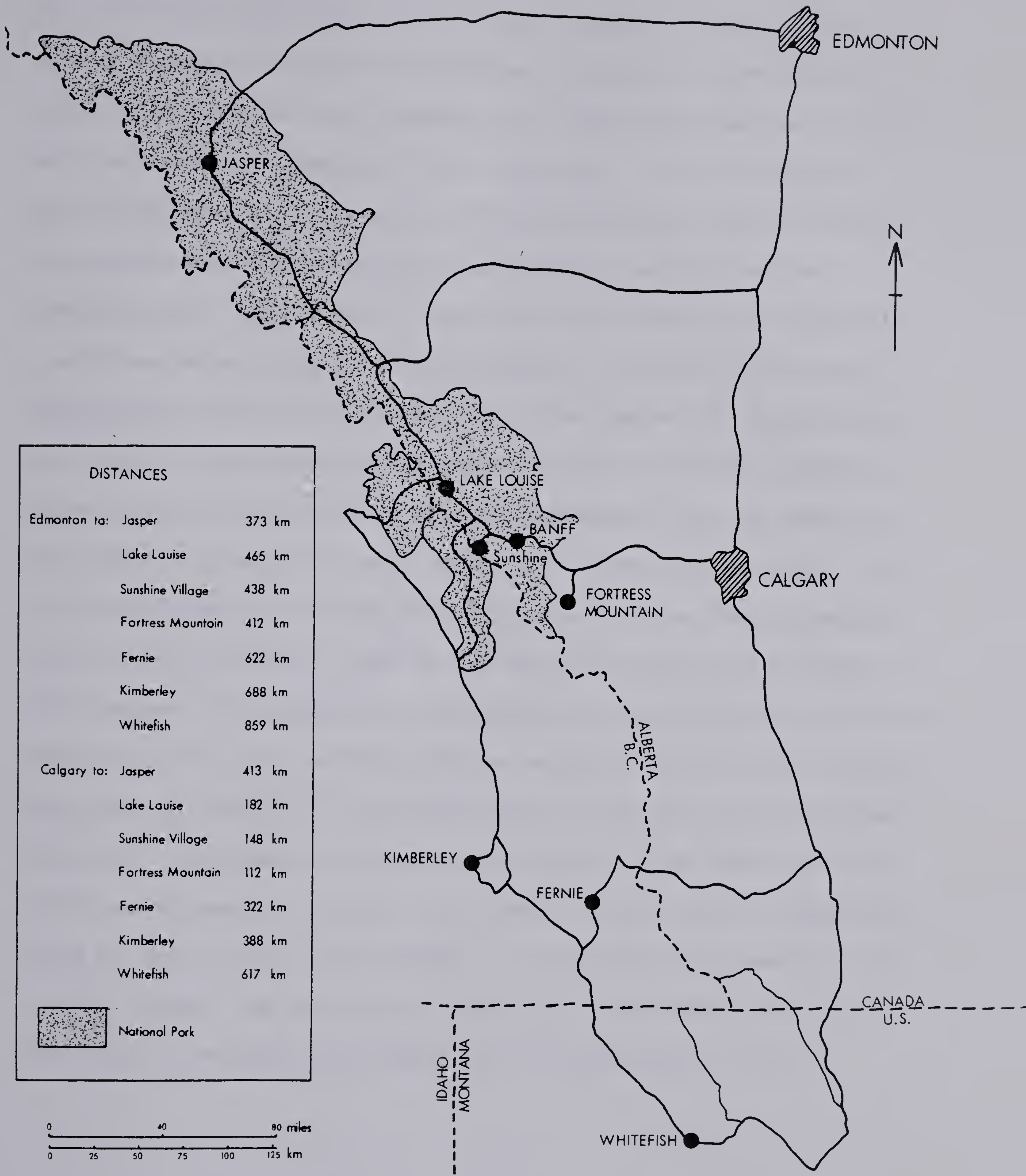

Fig. 1. Map of Study area

is a fast growing sport. In the two decades from 1956-76, skiing in Alberta grew at an annual rate of 18 per cent.[10] Since 1976 however, the growth rate has decreased to 7.5 per cent per annum.[11] Despite this decrease, the ski industry generated $40 million in the 1978-1979 season over a total of approximately one million skier days, which can be compared with the 1975-76 figure of $27.5 million over half a million skier days.[12] Unfortunately for both skiers and developers alike, the increase in the number of skiers has resulted in considerable pressure on the existing resorts, especially at peak season and on weekends. Because most of the Albertan resorts are located within National Parks, only limited expansion at the existing resorts can take place to relieve the pressure, and no new developments are allowed. A high degree of crowding is abhorrent to many skiers, who are beginning to seek resorts further afield. This latter factor provides an occasion for comparing the perceived locational error for the familiar Albertan resorts, with that for the relatively unknown areas. Since many of the newly frequented resorts are in British Columbia, incorporating them into the thesis allows the additional study of the effects of the provincial and physical boudaries on perceptual error.

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[10] ibid.
[11] Personal Communication with Alberta Business Development and Tourism.
[12] Alberta Business Development and Tourism, (1976). op. cit., footnote 9.

1.5 Structure of the Thesis

Some of the literature pertinent to the study will be discussed in Chapter 2. The mental maps obtained from the skiers (Chapter 3) are in the form of x,y co-ordinates. This type of point data is suitable for analysis by centrographic and regression techniques. The methodology which is outlined in Chapter 4, is aimed at identifying the amount of error in the mental maps of different variable (or behavioural) groups. The different measures are subsequently used to test the hypotheses and the results obtained from the analyses are discussed in terms of within-group similarities and between-group differences (Chapter 5). Additional data derived from the questionnaires concerning revealed and stated preferences of the resorts are included in Chapter 6 to help contribute to the explanation of the results. A model is constructed in Chapter 7 to synthesize the findings and to clarify the relationships found in this study between behavioural variables and perception.

2. LITERATURE REVIEW

2.1 Introduction

Although the present interest in mental maps was initiated in the late 1950's and early 1960's by Boulding and Lynch, the concept of mental maps was first introduced by Trowbridge in 1913.[1] The term he used was 'imaginary maps' since the maps represented the world as the individual imagined it to be, not as it really is. At that time Trowbridge estimated that as many as 30-50% of the population possessed imaginary or erroneous maps, while the remainder imagined the world 'accurately' as it is found in reality.[2] Since then however, it has been established that everyone possesses mental maps, with some being more accurate in terms of objective reality than others.

One of the main reasons for the current revival of interest in perception lies in the premise that it is not what exists, but how something is perceived by an individual that becomes salient in the mind of that person.[3]

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[1]K.E. Boulding (1956). The Image. Ann Arbor, University of Michigan Press. K. Lynch, (1960). The Image of the City. Cambridge, Mass.: M.I.T. Press. C.C. Trowbridge, (1913). "On Fundamental Methods of Orientation and Imaginary Maps." Science, 38, 888-97.
[2] C. C. Trowbridge, (1913). op. cit. footnote 1.
[3] See for example: D Lowenthal, (1972). "Research in Environmental Perception and Behaviour." Environment and Behaviour, 4, 333-341; H.C. Brookfield, (1968). "On the Environment as Perceived." Progress in Geography, 1, 53-80; D. Stea and R.M. Downs (eds.), (1970). "From the Outside Looking In at the Inside Looking Out." Environment and Behaviour, 2, 3-12; D. Ley, (1977). "Social Geography and the Taken-for-Granted World." Transactions of the Institute of British Geographers, 2,(4), N.S. 498-512; R.M. Downs,

Since we base our decisions and subsequent behaviour on what we know in our minds then our perceptions become fundamental to our resultant behaviour. Formerly, geographers described behaviour as it was revealed and by a posteriori reasoning, inferred the causes of that behaviour. Currently, the procedure is reversed; by determining the perceptions of individuals, their resultant behaviour may be deducted and thereby, allow predictions to be made. This approach is appealing to geographers since it no longer merely describes the pattern that is produced by behaviour, but instead, investigates the processes that are involved. For example, Craik has pointed out that

> It is indispensable to take perceptual/cognitive structures into account if we are ever to achieve the predictive power over behaviour in physical and social settings so badly needed by the planning disciplines.[4]

Gould also saw the need for the study of perceptions since planning decisions are attempts to manipulate the environment subject to many man-made constraints.[5] Lee saw the use of knowing and understanding the factors that influence perceived distance as having practical applications in the siting of such facilities as shops,

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[3](cont'd)1970). "Geographic Space Perception: Past approaches and Future Prospects." Progress in Geography, 2, 67-108.

[4]K.H. Craik, (1972). "Psychological Factors in Landscape Appraisal". Environment and Behaviour, 4, 255-266.

[5]P.R. Gould, (1975). People in Information Space: The Mental Maps and Information Surfaces of Sweden. Lund Studies in Geography, No. 42 (B).

leisure centres and churches.[6] Sonnenfield sums up the need more generally by commenting:

> Understanding the sources of variance in environmental perceptions is essential to an understanding of variation in man's environmental behaviours.[7]

The more specific appeal of the mental map is that it may be reproduced in a cartographic form and therefore can be visually examined and compared. A final comment concerning the reasons for studying mental maps is from Trowbridge who succinctly observed that the effect of mental images on a person's day to day living was important because mental maps "are at the foundation of the ordinary process of thinking."[8]

An attack on behavioural geography has been made by Bunting and Guelke who do not object to the basic premise that "individual decision-making and actual or real-world behaviour can be better understood in terms of perceived images and subjective evaluations of the environment".[9] What they do object to is that results from research in this field are not in a form that can be used by other geographers in the explanation of actual, real-world human activity. They consider this to be a basic weakness in the

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[6]T. Lee, (1970). "Perceived Distance as a Function of Direction in the City". Environment and Behaviour, 2, 40-51.
[7]J. Sonnenfield, (1967). "Environmental Perception and Adaptation Level in the Artic", in Lowenthal, D. (ed), Environmental Perception and Behaviour. Department of Geography Research Paper No. 109, University of Chicago, Ill., 42-59.
[8] C.C. Trowbridge, (1913). op. cit. footnote 1.
[9]T.E. Bunting and L. Guelke, (1979). "Behavioural and Perception Geography: A Critical Appraisal." Annals of the Association of American Geographers, 69 (3), 448-62.

whole approach, and reason that it is because of this that no general theories have been formed which significantly augment our understanding of man-environment relationships.[10] Instead they propose that a more valuable approach would lie in the observation and description of individual behaviour because it would "provide solid empirical and geographical foundations for interpretive scholarship".[11] Rushton asserts that the research philosophy of the behavioural geographer regards overt behaviour as the outcome of a decision-making process in a unique environmental setting.[12] Bunting and Guelke suggest that instead we should study individual behaviours in the real world and then seek out the perceptions of distinct activity groups. The previous discussion has shown that the value of perception in the explanation of spatial behaviour lies in the fact that it allows the researcher to move away from the traditional descriptive methods and to advance to an examination of the inherent processes instead. Therefore their suggested approach is not only retrogressive but also untenable.

There have been a number of applications involving the use of mental maps at varying scales and using a variety of methods to expose the map or image in a person's mind. The scale of enquiry ranges from the size of a university campus

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[10] ibid.
[11] ibid.
[12] G. Rushton, (1979). "Commentary on 'Behavioural and Perception Geography' by T.E. Bunting and L. Guelke". Annals of the Association of American Geographers, 69 (3), 463-64.

and city neighbourhood to national and global perception. At each scale, the elements of the mental map are different; at the neighbourhood scale, the maps may be very detailed and the components derived largely through direct experience. At urban and regional scales, the maps may be derived through both direct experience and general indirect information, with the amount of detail varying with the derivation of the information. On a global scale, shape and size will be the major map components, with limited detail.

The following discussion will examine some of the applications of mental maps, such as finding the image of a city, social perception, shape perception, regional preferences and distance estimation. The respective methods involved in obtaining the maps will also be discussed.

Mental maps may be derived by either direct or indirect means.[13] Direct techniques require the subject to draw sketches or plot points directly on to a sheet of paper. This type of map is planimetric since the respondent has to provide directional and distance information. Beck and Wood regard this technique as being the proper definition of a mental map since it requires the subject to actually draw what is in his head.[14] The indirect technique on the other hand derives factual information via questionnaires and tests which is then interpreted by the researcher and input

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[13]D.C.D. Pocock, (1976). "Some Characteristics of Mental Maps: An Empirical Study." Transactions of the Institute of British Geographers, 1 (4), N.S., 493-512.
[14]R.J. Beck and D. Wood, (1976). "Cognitive Transformation of Information from Urban Geographic Fields to Mental Maps". Environment and Behaviour, 8 (2), 199-238.

to a common mental map.

2.1.1 Direct Technique

Lynch designed a method to measure public images of the cityscape.[15] While he recognized that all images are unique, he assumed that there would be large areas of agreement between respondents. The ability of people to form images of a city and the degree of agreement between respondents concerning the city's image are qualities which Lynch termed 'imageability'. The imageability of a given city is dependent on a number of factors such as structure, continuity, distinctiveness, but cities do not necessarily have to have a simple structure in order for people to orient themselves. For example Paris is readily perceived, not on account of its simplicity, but due to its imageability.[16] On the other hand, a city with a simple but rigid grid-iron layout, may be much harder to apprehend because of its lack of distinctive features, which are used by an individual as sensory clues for orientation.

By asking people to sketch a map of the city in which they were residents, provide descriptions of the trips they made and to list those features that they felt to be most distinctive, Lynch was able to discuss the imageability of the city in terms of several main elements: paths, edges, districts, nodes and landmarks. By compiling these elements,

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[15] K. Lynch, (1960). op. cit., footnote 1.
[16] See S. Milgram, (1977). The Individual in a Social World. Addison-Wesley Publishing Co., Chs. 5 and 6.

he constructed a series of maps of the three cities he investigated - Los Angeles, Jersey City and Boston.[17] As a result, Lynch concluded that people consistently use and organise the many elements of a city to help them orient themselves.[18] The degree to which this is achieved is dependent upon the city's imageability. Although this work was generally praised, there was some criticism regarding the small size of his sample and his method of presentation of the final map images, where the images of respondents were transferred to accurate base maps, thereby mixing subjective and objective data in the maps. DeJonge set out to verify Lynch's method at a less elaborate, yet larger scale.[19] He studied the mental images of five Dutch cities given by a much larger subject population than that used by Lynch. His results confirmed both the usefulness of Lynch's technique and his conclusions concerning image formation.[20] DeJonge's study also provides empirical evidence that the Lynchian technique may be applied in culturally different cities with considerable success.[21]

Milgram recognized the value of Lynch's methods of determining a city's imageability, but felt that further research should be directed towards "the measurement of the exact degree of cognitive significance of any one point in

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[17]K. Lynch, (1960). op. cit. footnote 1.
[18]ibid.
[19] D. DeJonge, (1962). "Images of Urban Areas." Journal of the American Institute of Planners, 28, 266-76.
[20]ibid.
[21]ibid.

the city relative to any other point".[22] In other words, his aim was to go beyond a city's imageability and discover its recognizability. He conducted his study in the city of New York, and asked a representative sample of citizens to identify a set of photographs which were taken at grid intersections across the city.[23] He concluded that an area will have a high index of recognizability if many people are exposed to it; thus an area which is centrally located in relation to the major population flow will be highly recognizable. In addition, a culturally or socially distinct area will also maintain a high recognition index value.[24]

The sketch technique may also be used to depict the psychological boundaries and barriers within a city, which do not always conform with the physical or administrative boundaries. Milgram used photographs and questions to supplement the sketch maps he obtained from a sample of respondents in Paris in order to find the psychological core of the city, the socially distant parts, the areas of confusion, the dangerous sections and the best-loved areas.[25] The resulting mental maps are multi-dimensional since they contain cognitive, emotional and intuitive components. Another application of the sketch map to reveal the 'invisible' surface of the city was undertaken by Ley, who set out to discover the location of dangerous sections

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[22] S. Milgram, (1977). op. cit. footnote 16.
[23] ibid.
[24] ibid.
[25] ibid.

in Philadelphia.[26] These types of studies are especially helpful to sociologists and urban planners, to aid them in such matters as administrative zone designation, suburb development and neighbourhood planning.

At a larger scale, Sanders and Porter obtained sketch maps of Africa.[27] In this study, they were less concerned with content than with shape, and by using factor analysis they were able to separate measurement error from systematic misrepresentations of the African shape. Pacione used a similar measurement technique to analyze sketch maps of Great Britain.[28] These maps, however, differed from the African study because the respondents were required to put as much information on them as possible within a given time limit. The objectives of the study then were two-fold: (1) to examine the shape of cognitive maps of Great Britain in order to identify major errors, and (2) to explain the internal structure of the revealed mental maps.

The major advantage of the sketch map technique for deriving individual's mental maps lies in the fact that what the respondent includes and omits is directly from his mental image, and is not prompted by something, of which he might not have been aware. The greatest disadvantage of this

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[26] D. Ley quoted in R.M. Downs and D. Stea, (1977). Maps in Minds - Reflections on Cognitive Mapping. Harper and Row Publishers, p.15.

[27] R.A. Sanders and P.W. Porter, (1974). "Shape in Revealed Mental Maps". Annals of the Association of American Geographers, 64 (2), 258-267.

[28] M. Pacione, (1978). "Information and Morphology in Cognitive Maps". Transactions of the Institute of British Geographers, 3 (4) N.S., 548-568.

method is the interference of graphic ability with reproduceability. Does the respondent really have a map like that in his head or is he a poor artist and cannot tranfer what he sees in his mind's eye to a piece of paper? Although these problems were recognized by Pacione, and by Sanders and Porter, they did not address them specifically.[29] Murray and Spencer have addressed this issue and they also recognized that the strength of the ability to form environmental images might also be a contributory factor.[30] Therefore, they set up tests to compare both graphic ability with the accuracy of mental maps, and the strength of environmental images with the content of mental maps. Both comparisons showed only weak positive correlations. Therefore, Murray and Spencer concluded that the production of environmental images and maps is largely independent of both the individual's drawing talent and his ability to call up environmental images.

2.1.2 Indirect Methods

The major exponent of the indirect method is Gould.[31] His respondents were not required to draw maps, but merely

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[29] M. Pacione, (1978). op. cit., footnote 28; R.A. Sanders and P.W. Porter, (1974). op. cit., footnote 27.
[30] D. Murray and C. Spencer, (1979). "Individual Differences in the Drawing of Cognitive Maps: The Effects of Geographical Mobility, Strength of Mental Imagery and Basic Graphic Ability". Transactions of the Institute of British Geographers, 4 (3) N.S.
[31] Among the works of P.R. Gould, see especially: On Mental Maps, Discusion Paper No. 9, University of Michigan, 1966; "Structuring Information on Spatio-Temporal Preferences." Journal of Regional Science, 7 (2), 1967; Mental Maps. Penguin Books Ltd. Middlesex, U.K.

to utilize their judgement in ranking a set of places in terms of residential desirability. Their perception of distance to those places is never tested. The mapping is derived by finding the amount of agreement present within the set of respondents concerning the desirability of each place. The measurement of agreement is found by using principal components analysis and each place can then be assigned a group preference value, allowing contour maps to be constructed over the surface of concern. These are not mental maps in the Lynchian sense, since they are textual rather than spatial, and also, they are not <u>derived</u> planimetrically, although the resultant maps do contain the basic elements of geographic planimetry.

A number of studies have dealt more specifically with the spatial elements of cognitive structuring. Canter and Tagg carried out a study concerning the estimation of distance between pairs of points in seven cities in five different countries.[32] The subjects were asked to estimate the crow's flight distance between each set of well-known points in each city. The authors found a consistent overestimation of distance in all the cities. Working from the aggregate distance estimates, Canter and Tagg were then able to produce sets of maps which compared the actual and estimated configurations of the city space. Lee's results from a survey conducted in Dundee, Scotland, supported Canter and Tagg's generalization that people consistently

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[32]D. Canter and S.K. Tagg, (1975). "Distance Estimation in Cities". <u>Environment and Behaviour</u>, 7 (1), 59-80.

overestimate distances.[33]

These studies are less concerned with assigning a descriptive image to a city, than with quantifying the perceptions of city space. These numerical methods lend themselves to such analysis techniques as multi-dimensional scaling (MDS). For example, Zeller and Rivizzigno used cue sets of points in a city to test whether distance estimations become more accurate over time, with increased knowledge of an area and with familiarity.[34] Individual mental maps can then be created from the estimation of relative distances between the point locations using MDS techniques. Golledge, Rivizzigno and Spector carried out a similar study in Columbus, Ohio, in which they discussed the problems of cue identification and the effect directional bias has on the construction of a composite cognitive map.[35]

The advantage common to these spatially oriented studies lies in the fact that the locations of a finite number of points are fixed and the interpoint distances are known.[36] The deviations of the estimates can then be related

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[33] T. Lee, (1970). "Perceived Distance as a Function of Direction in the City." Environment and Behaviour, 2, 40-51.
[34] R.L. Zeller and V.L. Rivizzigno, (1974). Mapping Cognitive Structures of Urban Areas with Multidimensional Scaling: A Preliminary Report. Discussion Paper No. 42, Department of Geography, Ohio State University.
[35] R.G. Golledge, V.L. Rivizzigno and A. Spector, (1976). "Learning about a City: Analysis by Multidimensional Scaling", in Golledge, R.G. and G. Rushton (eds.), Spatial Choice and Spatial Behaviour. Ohio State University Press, Columbus, 95-116.
[36] M.F. Goodchild, (1976). "Perception, Preference and Geometry: A Commentary", in Golledge, R.G. and G. Rushton (eds.), Spatial Choice and Spatial Behaviour. Ohio State University Press, Columbus, 179-188.

to the fixed points, and stress factors and specific areas of distortion measured, not merely described. Once we have found such a measure, it is possible to input this value to models which may enable us to predict human behaviour, such as journeys within the city, the propensity for industries to locate, and the destination of migrants.

One area that has been largely neglected is the perception of location at a regional scale. Implicit in this type of study are a number of interesting conceptual problems: respondents have to estimate distances at a larger scale than that used in urban enquiries; the effect of increasing distance on perceptual error; the perceptual range of an individual or group; whether locations which are the single destination of a given trip are perceived as being positionally related to other destinations or whether they are perceived solely in relation to the origin of that trip; how non-direct, that is circuitous routes affect an individual's perception of the direction of the given location in respect to the origin; and how perceptual error will vary with the type of behaviour associated with each destination.

The proposed study intends to examine the above problems and attempt to offer some explanations to them. It was mentioned in the introduction that a recreational activity will be used for a case study; the mental maps obtained will be skiers' perceptions of the locations of seven Rocky Mountain ski resorts. Since the distances to

these resorts vary considerably, distance estimation, the effect of distance decay and perceptual range may be tested. Due to the large distances involved between the origins of Edmonton and Calgary to the resorts, and between the resorts (Figure 1), ski trips generally have only one destination. With one exception, the fastest routes to the resorts do not involve passing any of the other specified ski areas, leading one to postulate that for such a location-oriented activity each resort is perceived in relation to the origin, not in relation to the positions of the other resorts. This study therefore, is interested in how the respondents locate each resort in relation to their origin.

The study includes both direct and non-direct routes to the resorts, so that the effects of orientation can be examined. Finally the maps will have to be in the form that will facilitate the measurement and comparison of the error. The data obtained from the questionnaires must be in such a form that variable groups based on behaviour can be derived.

2.2 Measurement of Mental Maps

A number of different methods for measuring mental maps have been mentioned in the above review of the literature. Most of these methods concentrate on how to extract the mental map from a person's head to a two-dimensional sheet of paper. Some require the respondents to draw sketches only, some supplement sketches with questionnaires, and others use only tests and questionnaires.

When sketch maps have been obtained, methodological concerns have been primarily directed towards the problems of scaling the maps so that direct comparisons can be made. Since each mental map in the sketch form is composed of different elements, comparison is difficult leading researchers to emphasize the common elements on the maps rather than the differences. Mental maps obtained by the indirect method described above lend themselves better to measurement, since the estimates of distance may be directly compared to the actual distance between points. The length of the over- or under-estimation may be regarded as the amount of error present. All mental maps possess a certain amount of error, especially when dealing with less familiar areas, lending credence to Watson's statement that "they (mental maps) tend to fuzzy, especially at the peripheries of knowledge".[37] In other words there are few sharply defined edges or distances in an individual's mental map. This has led Tobler to stress that error in mental maps is located in those fuzzy areas and that measurement of the fuzziness or discordance is more worthwhile than presenting the average or concordant map.[38]

The best methods to use in order to achieve the aims of this study are to use a combination of a mapping test, which

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[37] J.W. Watson, (1972). Mental Distance in Geography: Its Identification and Representation. Paper presented at the International Geographical Congress, Montreal.
[38] W.R. Tobler, (1976). "The Geometry of Mental Maps", in R.G. Golledge and G. Rushton (eds.), Spatial Choice and Spatial Behaviour. Ohio State University Press, Columbus, 69-81.

would require the respondents to plot the ski resort locations in relation to their origin, and a questionnaire to supply behavioural data. The perceived locations on the map will be in the form of points which will be recorded as x,y co-ordinates. Data in this form allows the amount of perceptual error in terms of both distance and direction, to be measured and the results compared with the actual locations. The findings then will be discussed in terms of variable groups derived from the behavioural data.

2.3 Variable Groups

Most of the research into mental maps has involved the use of one, or a combination of variables. The primary ones that have been used in testing percptual error, comparing sketches and evaluating distance estimations are: familiarity; length of residence in an area; preference; attractiveness of the destination; sex; and socio-economic factors. In the present study, socio-economic characteristics will be held constant at the sampling stage in order to obtain a control (this will be discussed more fully in Chapter 3). The other five variables will be incorporated into the study in order to help explain the results.

2.3.1 Familiarity

This variable has been widely used in perception research because it is one of the more important conditions

for the development of perceptual images over time. Holahan and Dobrowolny examined behaviour patterns in an environmental setting to learn how the cognitive map of that setting is formed.[39] Their three main variables were 'frequency of use', 'sitting' and 'socialising'. They found a strong relationship between the amount of detail on the maps and frequency of use, which may also be regarded as familiarity. Pocock also related detail on mental maps to familiarity of the city of Durham, England.[40] He based his familiarity variable on the number of visits made to the city. Banas and Shaw in a study of the use of recreational facilities in Chicagoland tested the variable 'familiarity' against preferences for different facilities, and found a strong relationship.[41] The effect of familiarity on perception is best summed up in a paper on the estimation of distances by Golledge, Briggs and Demko, where they discovered that:

> The precision with which places are located on a map relative to each other depends to a large degree on the individual's familiarity with the places. A high degree of familiarity should result in conformity

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[39] C.J. Holahan and M.B. Dobrowolny, (1978). "Cognitive and Behavioural Correlates of the Spatial Environment: An Interactional Analysis." Environment and Behaviour, 10 (3), 317-33.
[40] D.C.D. Pocock, (1976). op. cit. footnote 13.
[41] J. Banas and W. Shaw, (1971). "The Perception of Recreational Opportunity in Chicagoland", in M. Tucey and R. White (eds.), Geographical Studies in Environmental Perceptions. Research Report No. 61, Department of Geography, Northwestern University, Illinois.

[42]between perceptual and physical locations.

The familiarity variable in this study will be described by three behavioural characteristics: whether a person has ever visited a resort before; the frequency of visit per year; and the number of years of ski trip experience in the area.

2.3.2 Length of Residence

Beck and Wood dicuss the effect of the length of residency on the perceptions of an urban environment.[43] They set out to verify the axiomatic premise that long term residents make better maps in content and veridicality than new residents. In addition they found a more interesting fact; people who have lived in an environment between three and seven years outperform longer residents (more than fifteen years) and recent arrivals (residents less than three years). Golledge _et al._ link the learning effect with length of residency and tested how this effects the mental maps over time.[44] Although this thesis does not deal with an urban situation, the respondents are taken from the two main urban centres of Alberta and knowledge of the surrounding region as well as of the cities themselves will change with the length of residency, thereby affecting perceptions.

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[42] R.G. Golledge, R. Briggs and D. Demko, (1969). "The Configuration of Distances in Intra-Urban Space." _Proceedings of the Association of American Geographers_, 1, 60-65.
[43] R.J. Beck and D. Wood, (1976). _op. cit_. footnote 14.
[44] R.G. Golledge, V.L. Rivizzigno and A. Spector, (1976). _op. cit_. footnote 35.

2.3.3 Preference

Goodrich uses 'preference' in a model to predict the choice of recreation destinations.[45] He found that the attractiveness of a resort and the individual's preference are strongly linked in the final determination of 'where to go'. Ewing and Kulka studying ski trip behaviour in Vermont also relate preference and attractiveness with actual behaviour.[46] This present study investigates whether skiers tend to actually go to their most preferred resort or whether they have to compromise for some reason - usually a combination of time and cost.

2.3.4 Attractiveness

The above discussion of preferences revealed how preference and attractiveness are linked. A number of studies have used attractiveness in a model to predict the number of visits that will be made to a resort given various population parameters and alternative choices.[47] Lee however isolates the effect of the attractiveness of a point on the

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[45] J.N. Goodrich, (1978). "The Relationship between Preferences for and Perceptions of Vacation Destinations: Application of a Choice Model." Journal of Travel Research, 17 (2), 8-13.

[46] G.O. Ewing and T. Kulka, (1979). "Revealed and Stated Preference Analysis of Ski Resort Attractiveness." Leisure Sciences, 2 (3,4), 249-75.

[47] For example: H.K. Cheung, (1972). "A Day-Use Park Visitation Model." Journal of Leisure Research, 4 (2), 139-55; D.M. McAllister and F.R. Klett, (1976). "A Modified Gravity Model of Regional Ski Trip Activity with an Application to Ski Trips." Journal of Leisure Research, 8 (1), 21-34; W.E. Johnston and G.H. Elsner, (1972). "Variability in Use among Ski Areas: A Study of the California Market." Journal of Leisure Research, 4, 43-49.

perception of distance to that point.[48] In his Dundee study, he uses this factor to explain the greater accuracy of women when judging the distance towards the downtown area; he reasons that women will be more attracted to this area than men, because of its shopping facilities. This thesis will try to see if the attractivity of a resort will exert an influence on the accuracy of its perceived location.

2.3.5 Sex

Beck and Wood reported on two laboratory studies involving orientations, and the location of distant points, in which women performed significantly poorly.[49] Beck and Wood group the variable 'male' with 'age' and 'jobs' because they propose that womens' performance in perception tests may be related more to their social role than to their sex itself, that is, they have for example, less exploratory freedom, learn to drive at a later age, and are more likely to engage in guided passive travelling.[50] Lee asked subjects to estimate the inward and outward distances in the urban area of Dundee, Scotland.[51] He found no difference between the sexes when averaged over all the conditions, but he suggested that discrepancies in the estimation of outward distances by women may be due to the fact that after a certain distance threshold, women perceive distances much less accurately than men. Some of these points will be

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[48] T. Lee, (1970). op. cit. footnote 33.
[49] R.J. Beck and D. Wood, (1976). op. cit. footnote 14.
[50] ibid.
[51] T. Lee, (1970). op. cit. footnote 33.

examined in the thesis.

The mental maps of the locations of the ski resorts will therefore be examined in terms of these variables: familiarity (split into 'visits'. 'frequency of visit' and 'experience'), length of residency, preference, attractiveness and sex.

3. DATA COLLECTION

3.1 Introduction

One way of looking at the perception-behaviour relationships discussed in the previous chapter is to take a case study which utilizes mental maps to test how the error in mental maps may be related to different behaviour groups. The recreational example used as the case study is downhill skiing. The study requires the skiers to plot where they perceive a series of ski resorts to be located in relation to the origin of the ski trip. The resorts chosen are: Marmot Basin, which is close to Jasper in the north of the study area, Lake Louise, Sunshine Village which is 20 Kms. west of Banff, Fortress Mountain, located in the Kananaskis valley west of Calgary, Fernie and Kimberley in the Purcell Range of eastern British Columbia and Big Mountain at Whitefish, Montana (see Figure 1). The sample of skiers was taken from the university populations of Edmonton and Calgary which are thus regarded as the origins. To obtain the information required, a mapping test and questionnaire had to be designed.

The focus of the mapping test was to ask respondents to plot each resort in relation to the origin. Since the object of the test was to acquire spontaneous mental maps without reference to maps and atlases, the mental maps had to be derived directly from respondents. This constraint precluded the use of self-administered and mailed questionnaire

methods of data acquisition and therefore interviews had to be conducted by the author. Subsequent to the mapping test, ski trip, social and attitude data were obtained through the use of a questionnaire. These data provided the information with which the maps were analyzed.

3.2 Questionnaire Design

One of the major problems of using a questionnaire is knowing if the same question means the same to every respondent and also if the respondents all mean the same when they give an answer on an attitudinal scale. This problem is known in social science research as reliability. Reliability does not necessarily ensure accuracy, but it does ensure a uniformity of answers, thereby making comparisons more meaningful.[1] Another problem encountered in questionnaire design is that of validity. The researcher must first ascertain whether his meaning of a particular concept and what the respondents understand by it, are the same. If the two interpretations of the concept do not coincide, the answers to that question will not be valid. One way of eliminating these problems is to use a pretest.

The questions for the pretest were constructed in order to find out if they were reliable, valid in terms of meaning and if the objectives of the study could be fulfilled. The questionnaire therefore, covered aspects of ski trip

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[1] E.R. Babbie, (1979). The Practice of Social Research. Wadsworth Publishing Co. Inc., Belmont, California.

behaviour, skier ability and experience, length of residency in the origin city and preference rankings (see Figure 2b). Two questions considered the attractive and unattractive elements of the resorts and one asked respondents to recommend changes.

The pretest was helpful in determining the importance of some questions and whether they should be included. It also helped define areas that had not been sufficiently covered. The inclusion of Fortress Mountain to the list of ski resorts was a major addition resulting from the pretest, because many people had mentioned it.

Perhaps the most substantial change which resulted from the pretest was in the mapping section. The pretest asked the respondents to mark all the resorts on one sheet of paper. The point of the mapping section was to find out the perceived location of each resort in relation to the origin. Studying the respondents as they completed the exercise revealed that while the first point was perceived in relation to the origin, the subsequent points were located in relation to each other and not to the origin. Therefore if the first point was located inaccurately, the other points were also inaccurate, even if they were not actually perceived that way. Instead the respondents were given eight sheets of paper, each with a scale of the distance between Edmonton and Calgary marked (Figure 2a). It was found that the mental map obtained by the latter method yielded results more in accordance with the aim of the study.

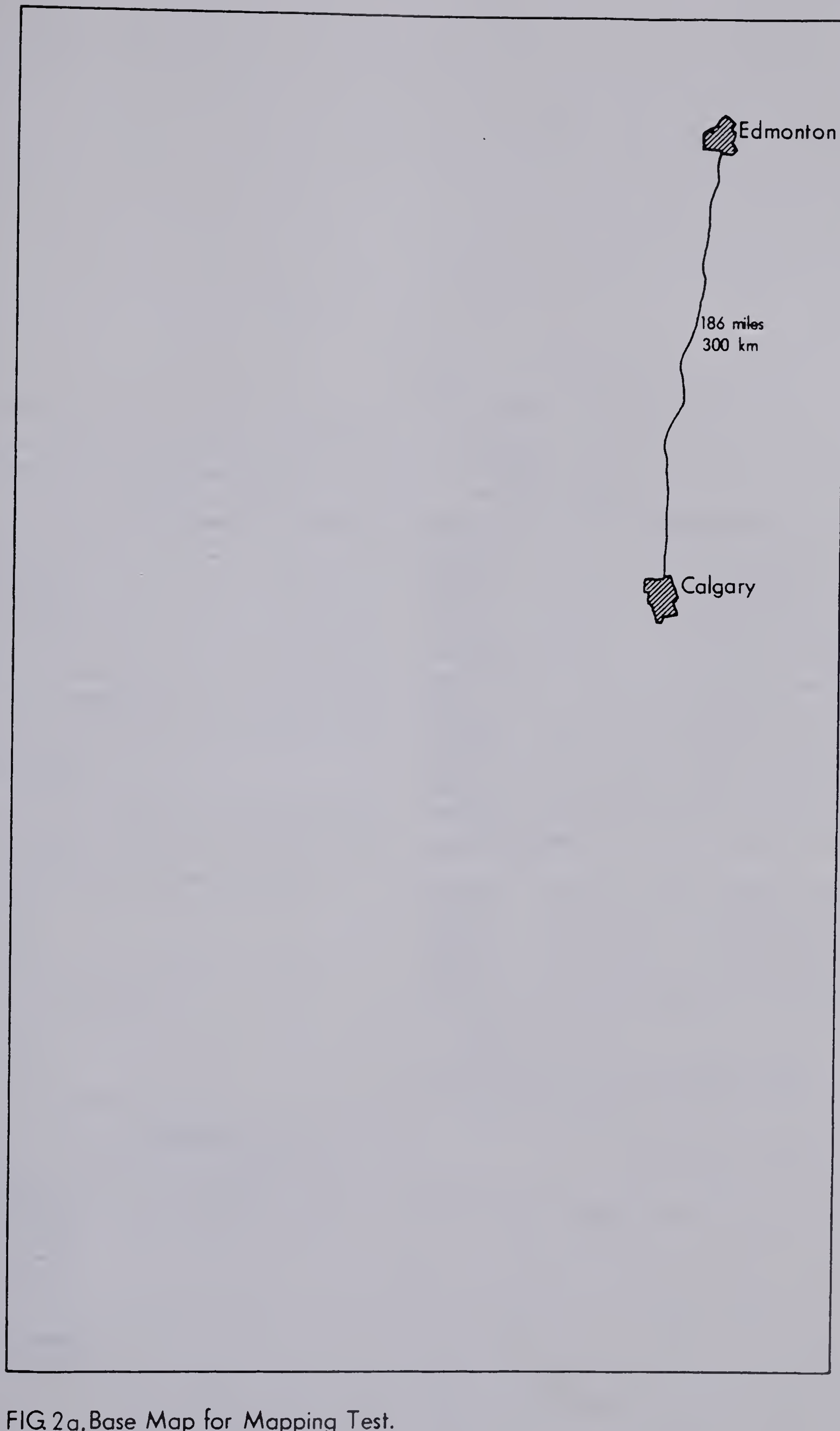

FIG. 2a. Base Map for Mapping Test.

Number ____________ Date ______________________ Location ____________________

The following questions are concerned with the extent of your ski-ing experience and knowledge of the ski resorts. You may need to keep referring to Card 1.

	M.B.	L.L.	S.V.	F.	K.	B.M.
1. Which of the ski areas on Card 1 have you visited before?						
2. Which of these frequencies (Card 2) best describes the number of visits you usually make to (above).						
3. What is the usual length of your visit to (A & B above)?						
4. Of these ski areas, which do you usually go to?						
5. Now, given no constraints, which of these resorts would you prefer to go to? Rank the areas on a acale from 1 (most preferred) to 6, (least preferred).						
6. From what source (Card 3) did you first hear about each of the ski areas?						

7. What type of transport do you usually use when travelling to ski areas?

Car (own ☐
Car (friends) ☐
Bus ☐
Train ☐
Other (please specify) ______________________

8. How many years have you been ski-ing regularly?

less than 1 ☐
1 - 5 ☐
6 - 10 ☐
more than 10 ☐

9. How well do you ski the following types of runs? (Card 4)

TYPE OF RUN	WELL	AVERAGE	POOR	NOT AT ALL
Green (easiest)				
Blue (more difficult)				
Black (most difficult)				

10. Is your equipment: your own ☐
borrowed ☐
rented ☐

11. Who do you usually go ski-ing with? (Check only 1)

Alone
With friends
With family
With family and friends
With a club or association

12. What do you consider to be the major attraction(s) of the ski areas on Card 1 (if any)?

Marmot Basin	
Lake Louise	
Sunshine Village	
Fernie, B.C.	
Kimberley, B.C.	
Big Mountain	

13. What do you consider to be unattractive about any of the ski areas shown on Card 1?

Marmot Basin	
Lake Louise	
Sunshine Village	
Fernie, B.C.	
Kimberley, B.C.	
Big Mountain	

14. Do you think any changes would increase the attractiveness of any of the sites? (Prompt, if yes, what?

Marmot Basin	
Lake Louise	
Sunshine Louise	
Fernie, B.C.	
Kimberley, B.C.	
Big Mountain	

15. Approximately how long have you been resident in:

Edmonton ____________
&/or Calgary ____________

16. Have you ever lived in any of the ski areas mentioned? YES/NO
If yes, which? ______________________________

17. Do you belong to any ski clubs? NO ( )
YES ( ) which

18. Sex: M /F

That's all, Thank you very much for your time.

FIG. 2b. QUESTIONNAIRE

There are two limitations connected with this technique: one, if people perceive the resorts relative to <u>each other</u>, then this technique interferes with the subjects' gestalt of the locations of the ski areas; two, the use of seven sheets of paper was rather more cumbersome than having one sheet per person.

If the study area was considerably reduced in extent, then the first limitation might have been relevant. The decrease in distance would increase the potential for interaction between the locations thereby allowing the locations of the resorts to be perceived with a greater degree of simultaneity. However, the study area is so large that few people travel <u>between</u> resorts, instead, they travel from the origin to one resort and then return directly to the origin. Therefore perceptions of the locations of the resorts tend to be of a one to one (bi-nodal) nature rather than polynodal. The only case where the resorts may be perceived positionally relative to each other is in the case of Lake Louise and Sunshine Village, because one has to pass Sunshine to reach Lake Louise. In addition these two resorts are close to each other (48 km.) allowing for the location of both to be perceived simultaneously. The nature, Province/State, distance and direction of Marmot Basin, Kimberley, Fernie and Big Mountain are so disparate that they are not positionally related in skier's perceptions, (see Figure 1).

A few changes in question order were made to the

questionnaire as a result of the pretest and the number of questions was reduced to a total of eighteen (Figure 2b). Eleven questions were direct-answer types; two used response categories; two were attitudinal and three were open-ended. There was no prompting given throughout the questionnaire.

3.3 Sample Choice

It was initially thought that the survey could be undertaken at each of the ski resorts, selecting only residents of Edmonton and Calgary. The identification of such a sample would necessitate a preliminary question as to their place of residence. This method was not utilized because the thesis requires people's perceptions from the origin to the ski resort and not vice versa. Perception maps obtained at the ski resorts could easily be 'back-to-front' and therefore misleading.

Sampling in downtown shopping malls was also considered, but after interviewing eighteen people with a pretest, it was felt that by taking socio-economic factors into account as well as the variables of ski trip behaviour, the relationship between behaviour and perception would be unclear. For example, it may be found that there is a strong positive relationship between frequency of visit and perception; there may also be a relationship between frequency of visit and age. In this case, hypotheses based on the assumption that frequency and perception are related may be wrong, if in fact the relation is between age and

perception; the independent variable has to be clearly defined in order to draw valid conclusions. To overcome this problem, it was thought necessary to implement a control on socio-economic factors, in other words, to hold a set of variables as constant as possible so that other relationships may be studied more easily. A control may be established either at the sampling stage or at the analysis stage by using the elaboration model in multi-variate analysis.[2] In this study, the control was established at the sampling stage because too large a sample would have been required to use the elaboration model. While a control on socio-economic factors does not totally isolate behavioural and perceptual links, it substantially reduces extraneous variables.

The physical nature of downhill skiing tends to restrict involvement to younger age groups; it is also a time-consumptive activity and therefore the amount of leisure time available to the skier, is an important factor. In a number of previous ski studies, it appears that the profiles of the 'average skier' and a student are very similar.[3] The social variables found to contribute to the profile of the most common participant skier are age; sex; marital status; occupation; education. Within each of these

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[2]E.R. Babbie, (1979). op. cit., footnote 1.
[3]Alberta Business and Tourism, (1976). Ski Industry Evaluation Study. Travel Alberta, Canada; Ontario Ministry of Industry and Tourism, (1978). Skiing at Ontario Resorts, Winter 1971-72. Tourism and Recreation Studies Branch, Report No.78; Stonehill, A. et al., (1973). The Oregon Ski Areas Study 1967-68 Winter Season. School of Business and Technology, Oregon State University.

groups the most predominant category can be recognized: 18-25 years old is the common age group; a 60:40 male-female ratio exists; most skiers are single; occupationally, skiers are divided between student and professional careers.

By selecting university students, a partial control is obtained on age group, education level, occupation and to a lesser extent, on income and marital status. A control on occupation means that the amount of leisure time available to each individual is approximately equal, which in turn has an effect on the total amount of participation possible within one season. An important consideration to be taken into account here is that by sampling students there might be an over-representation of the high participant skier, thereby biassing the sample. However in a given university population, while it is likely that a large proportion participate in downhill skiing, it was expected that the variation in frequency of participation and level of ability would be quite considerable.

3.4 Sampling Procedure

The next step was to find a sampling method that gives a representative set of respondents. The most acknowledged way of doing this is to use a systematic probability sampling method which ensures the representativeness of the sample based on probabilty theory. To implement this method, lists of the population from which the sample is to be drawn are required. In the present study 120 students from each

university campus in Edmonton and Calgary were selected, giving a total of 240 respondents. While lists of students are available, lists of downhill skiers are not, making formal probability sampling methods very difficult to implement.[4] Instead, a carefully constructed interviewing procedure was designed. To ensure a wide interest range of students, interviewing was divided between five different locations on both campuses. Figures 3 and 4 indicate interviewing locations.

In order to ensure that an equal proportion of men and women had an opportunity to be interviewed, male and female students were stopped alternately on a first encounter basis in each of the interview locations and were asked if they were downhill skiers. If they were not, then the interview did not proceed. If they were, then they were presented with a brief outline of the study which described what they were expected to do and how long the interview would take. Because skiing is of keen interest to most of those who participate, almost all students readily agreed to be interviewed. There was only one direct refusal and a few people did not have time at that point because of class and examination commitments.

The first part of the interview involved the mapping exercise; the student was presented with seven sheets of (14" x 8 1/2") paper each marked with a scale which

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[4] A list of downhill skiers could be obtained from the University Ski Club, but these would be by no means representative and also the problem of personally contacting those members for an interview would be difficult.

FIG. 3. Interviewing Locations on the University of Alberta Campus.

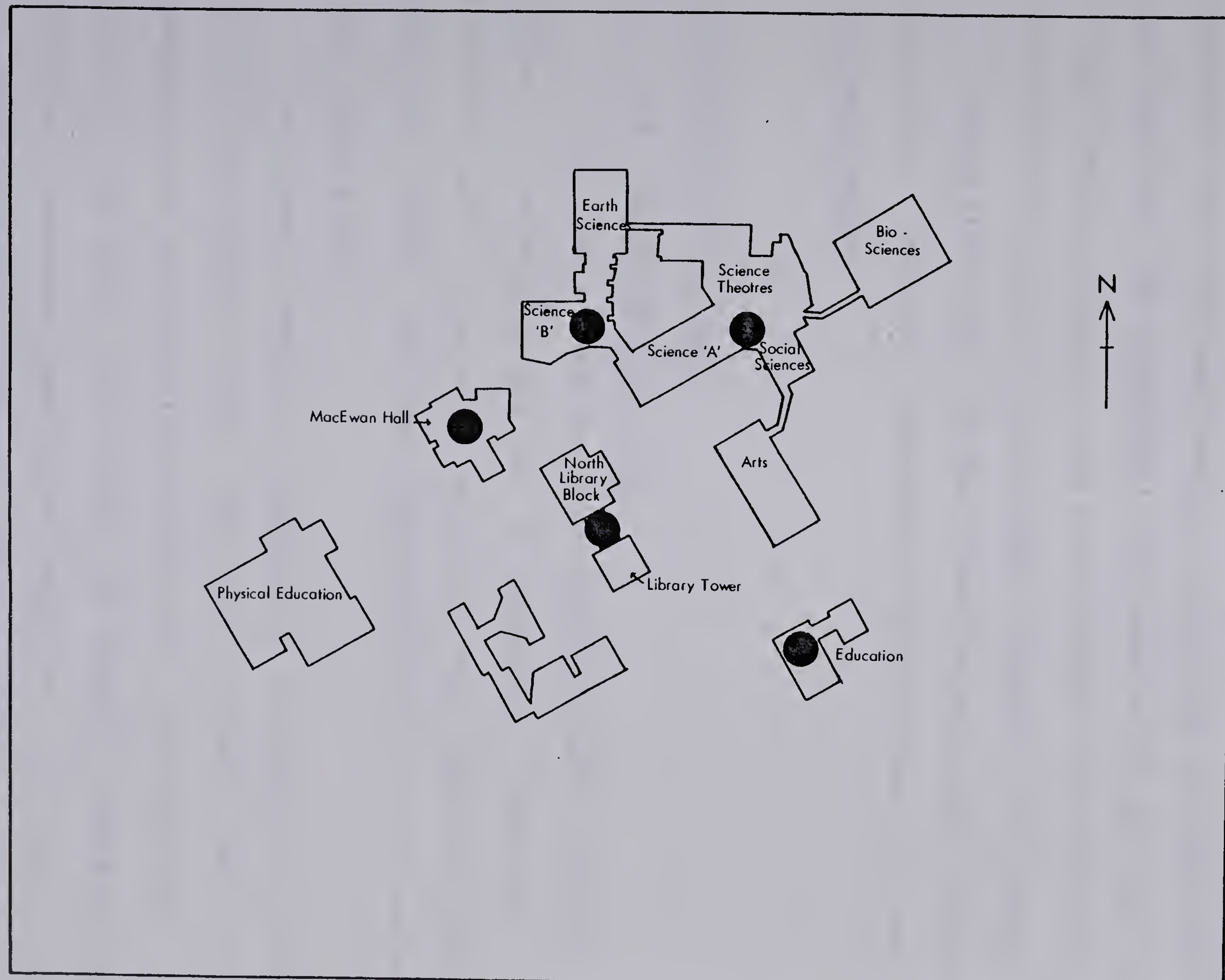

FIG. 4. Interviewing Locations on the University of Calgary Campus.

consisted of the cities of Edmonton and Calgary linked by Highway 2, together with the distance between the two cities in miles and kilometres (see Figure 2a). The scale and the size of the paper allowed at least a 10 cm. margin of error which at the scale used amounts to 250 km. As each ski area was read out, the respondent was required to put an X, one on each sheet of paper, where he thought each resort was located in relation to the origin (Edmonton or Calgary).

The written part of the interview was administered by the author. The whole interview lasted between ten and fifteen minutes.

3.5 Coding of the Data

3.5.1 Questionnaire Data

All the data from the questionnaires were coded by the author in the manner set out in Appendix 1. Questions 1-11 and 15-18 were close-ended questions and required simple numerical coding. The open-ended questions (12-14) were coded separately.

The comments made by respondents to Question 12 covered thirty-four aspects of ski area attractiveness. Most of the comments were easily categorized since they were very explicit, and often replicated; for example, there were many people who answered 'good snow condition' and 'size of area' as being attractive features. Other comments were rather more vague such as: 'nice atmosphere', 'nice place' and 'it's different' or 'I know it better'. Such comments either

necessitated their own separate category, such as 'Unknown' and 'Familiarity' and others were placed under existing categories such as 'friendly' and 'location'. The comments regarding unattractive or disliked features of ski resorts (Question 13) were coded in a similar fashion, but the number of aspects covered was lower than for Question 12, being only twenty-nine.

Once the data were recorded, they were keypunched for analytical use.

3.5.2 Map Data

Analysis of the maps required x,y referencing of the point locations. Each map sheet was overlain with a 14" x 9" grid and the x,y co-ordinates read off for each point to an accuracy of two decimal places. A set of seven x,y co-ordinates representing one person's perception of the seven ski resorts were then coded onto computer sheets. These data were also keypunched and verified.

The next chapter will discuss the derivation of the variables from the questionnaires and the methods used to analyze the maps.

4. ANALYSIS TECHNIQUES

4.1 Derivation of Variables

The rationale behind the choice of variables was outlined in Chapter 2. The following section will consider these variables with respect to the data. Table 1 shows how many of the respondents have ever visited each of the resorts. The effect of the closeness of Calgary to the main ski areas is apparent here, with Calgary respondents having made a total of 477 visits to Edmonton's 391. The distance effect is especially noticeable when looking at visits to Lake Louise; all but two of the Calgary respondents have visited Lake Louise once, as compared to twenty-eight non-visits in the Edmonton sample. A reverse situation exists when looking at Jasper, again because of the distance factor. For the Edmonton sample, the three most visited resorts are Sunshine, Marmot Basin and Lake Louise, while for Calgary, Lake Louise has received the most visits, followed by Sunshine Village and Fortress Mountain. The more distant places, as expected, have not been visited as much as the closer resorts.

Table 2a displays the frequency of visits made by respondents to each resort. When the tables for Edmonton and Calgary are compared, it can be seen that the Calgary skiers make considerably more frequent visits than Edmonton skiers, which may also be attributed to distance discrepancies. For the purpose of identifying variable groups, these figures

TABLE I. SKI AREAS WHICH HAVE BEEN VISITED.

	Edmonton				Calgary			
	Yes	%	No	%	Yes	%	No	%
Marmot Basin	94	78	26	22	36	30	84	70
Lake Louise	92	77	28	23	118	98	2	2
Sunshine Village	102	85	18	15	116	97	4	3
Fernie	20	17	100	83	36	30	84	70
Kimberley	25	21	95	79	35	29	85	71
Big Mountain	31	26	89	74	38	32	82	68
Fortress Mountain	27	23	93	77	98	82	22	18
Total	391		449		477		363	

TABLE 2a. FREQUENCY OF VISITS TO RESORTS.

Edmonton	Marmot Basin	Lake Louise	Sunshine Village	Fernie	Kimberley	Big Mountain	Fortress Mountain
> 5 times a season	12	6	7	2	1	0	0
2-4 times a season	40	24	30	3	0	3	4
Once a year	17	33	27	2	7	11	11
Once every few years	9	14	21	10	13	12	7
Never	22	23	15	83	79	74	78
Calgary							
> 5 times a season	1	38	42	3	0	0	20
2-4 times a season	2	32	37	6	2	5	27
Once a year	10	16	12	8	8	8	17
Once every few years	17	12	6	13	19	18	17
Never	70	2	3	70	71	68	18

* The figures are in percentages

TABLE 2b. FREQUENCY OF VISITS CATEGORIES GROUPED INTO TWO: HIGH FREQUENCY AND LOW FREQUENCY.

	Edmonton		Calgary	
	Visits 2 or more times per year (High frequency)	Visits less than 2 times a year (Low frequency)	Visits 2 or more times per year (High frequency)	Visits less than 2 times a year (Low frequency)
Marmot Basin	53	47	2	98
Lake Louise	30	70	71	29
Sunshine Village	37	63	79	21
Fernie	5	95	9	91
Kimberley	1	99	2	98
Big Mountain	3	97	5	95
Fortress Mountain	4	96	47	53

may be categorized into high frequency skiers who make a trip to a resort more than twice a year, and low frequency skiers who ski at a resort once a year or less (see Table 2b).

It can be seen in Table 3 that the predominant time unit for a ski trip from Edmonton is a weekend, accounting for 69% of all ski trips, whereas a day visit only accounts for 18% of all trips. This is in direct contrast to Calgary skiers, who, due to their proximity can make a day trip with ease and therefore do not need to incur further costs by staying overnight; 83% of skiers from Calgary make day visits, and only 15% spend a weekend.

Question 4 asked respondents to name the resort they usually go to and the answers are tabulated in Table 4. Clearly Marmot Basin is the most usual resort for Edmontonians (46%) and Calgary skiers are divided between Lake Louise and Sunshine Village (41 and 42% respectively). In a later section it will be seen if the usually attended resort is also the most preferred, or whether constraints of time and money dictate a compromise.

The distance involved to ski resorts from both cities places some emphasis on the mode of transport employed. Table 5 indicates that car transport is predominant, with a slight majority of people taking their own car. Nine per cent more people from Edmonton used a bus as a mode of transport than Calgary skiers, which could be attributed to organized ski club weekend trips offering cheaper rates.

TABLE 3. THE USUAL LENGTH OF A VISIT TO THE MORE FREQUENTLY VISITED RESORTS.

Edmonton	Marmot Basin	Lake Louise	Sunshine Village	Fernie	Kimberley	Big Mountain	Fortress Mountain	Total
1 day	5	22	27	83	0	0	0	18
Weekend	83	66	63	17	0	25	100	69
4 days	6	3	5	0	0	50	0	6
5 days	0	3	0	0	100	0	0	1
6 days	0	0	0	0	0	0	0	0
7 days	6	6	5	0	0	25	0	6
Calgary								
1 day	0	91	87	9	0	0	95	83
Weekend	100	9	11	82	33 67	5	5	15
4 days	0	0	0	9	0	0	0	0
5 days	0	0	0	0	0	17	0	0
6 days	0	0	0	0	0	0	0	0
7 days	0	0	2	0	67	17	0	2

* Figures are in percentages

TABLE 4. THE RESORTS WHICH ARE USUALLY VISITED.

Edmonton			Calgary		
Resort	%	Rank	Resort	%	Rank
Marmot Basin	46	1	Sunshine Village	42	1
Lake Louise	24	2	Lake Louise	41	2
Sunshine Village	23	3	Fortress Mountain	15	3
Big Mountain	4	4	Fernie	1	4.5
Fernie	2	5	Kimberley	1	4.5
Kimberley	1	6	Marmot Basin	0	6.5
Fortress Mountain	0	7	Big Mountain	0	6.5

TABLE 5. THE USUAL TYPE OF TRANSPORT USED IN SKI TRIPS.

	Edmonton %	Calgary %	Total %
Own car	45	64	55
Friends car	42	31	36
Bus	12	3	8
Other	1	2	1

TABLE 6. THE NUMBER OF YEARS OF SKIING EXPERIENCE.

	Edmonton %	Calgary %	Total %
< 1 year	2	2	2
1 - 5 years	57	46	51
6 -10 years	27	29	28
>10 years	15	23	19

It can be seen from Figure 5 that when questions 8 and 9 are combined, there is a strong positive relationship between the number of years experience and skiing ability. The majority of skiers are intermediate in ability and have between two and ten years experience. There are very few novices in the sample (8%) and only some self-acknowledged experts (21%). For further analysis, the experience data only will be taken for analysis, since it correlates closely with ability (see Table 6).

A large number of skiers from both cities own their own equipment (84%), with only 12.5% renting skis. This is surprising when it is considered that the sample is composed of students and a pair of skis alone may cost from $150 to $350.

In order to study the effect of the learning process on people's perceptions, it is instructive to look at the length of residency of the respondents in both cities. It is interesting to note in Table 7 that there is a peak in the more than fifteen years category and a secondary peak of newer residents in the 1-5 year bracket in Edmonton and a 6-10 years in Calgary.

Finally, Table 8 shows the number of male and female respondents in the sample. The male:female ratio in this study is comparable to that found in other studies, with Edmonton having a slightly higher proportion of men than

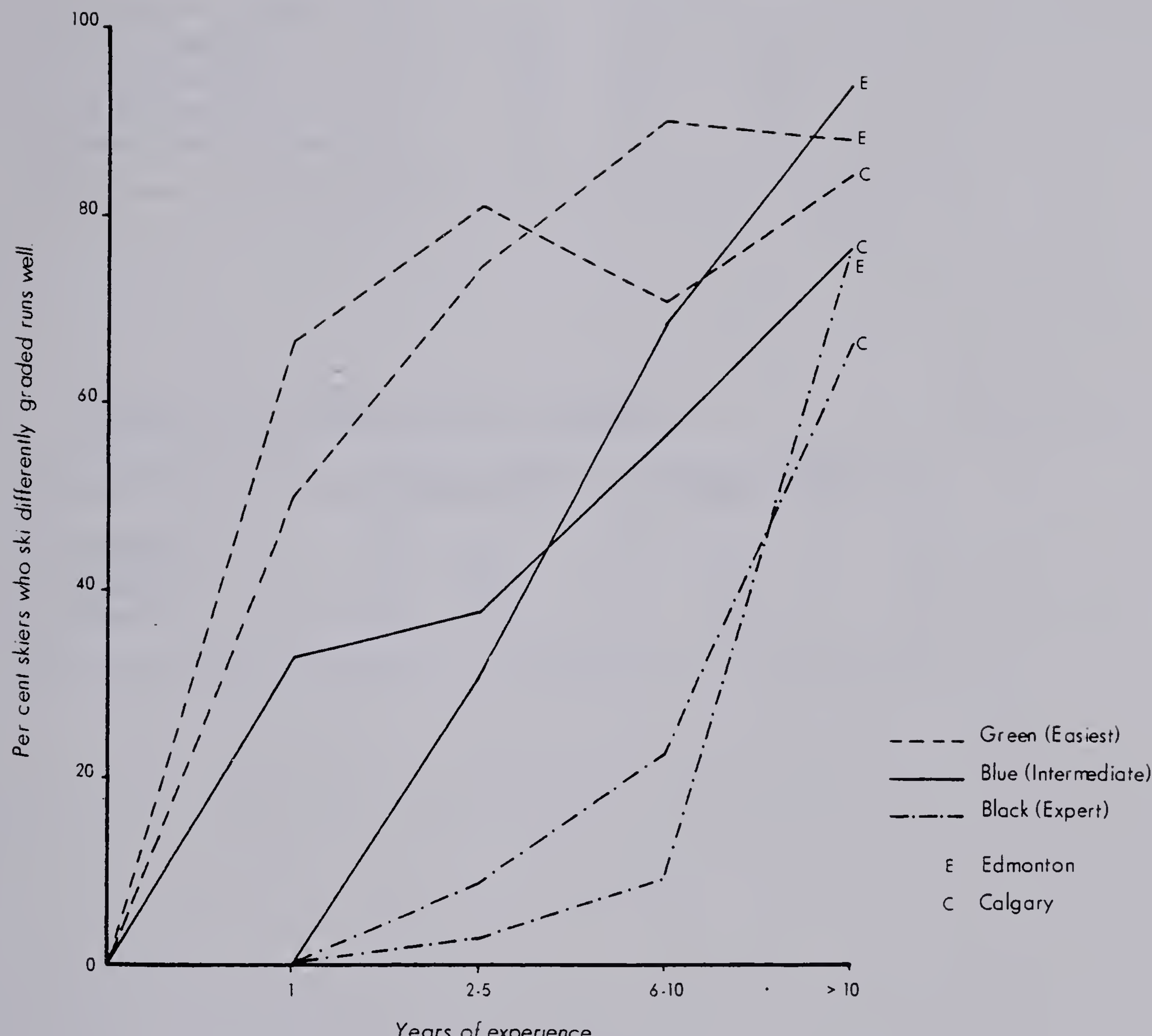

FIG. 5. The Relationship between Years of Skiing Experience and Ability.

TABLE 7. LENGTH OF RESIDENCY.

	Edmonton %	Calgary %
1 year or less	10	4
2 - 5 years	31	13
6 - 10 years	10	18
11-15 years	7	7
more than 15 years	42	58

TABLE 8. SEX COMPOSITION OF SAMPLE.

	Male (%)	Female (%)
Edmonton	68	32
Calgary	60	40
Total	64	36

women (68% to 32%) than Calgary (60% to 40%).[1]

Five of the above variables are used in the final analysis: 'visits', which may be split into those who have visited and those who have not visited a resort; 'frequency', which is divided into high frequency (twice a year or more) and low frequency (once a year or less); 'experience', where less than five years and greater than five years skiing experience are the two categories or strata; 'sex'; and 'residency' which may be stratified as 'one year or less', 'two to ten years' and 'more than ten years'. These variables will be tested to see how much each contributes to the error found in the mental maps. The methods by which the amount of error will be determined, is discussed in the proceeding section. The data obtained from the attractiveness questions and the preference rankings will be analyzed later in the discussion. The remainder of the data will be used to substantiate some of the findings.

4.2 Point Data Analysis

4.2.1 Introduction

As the variable groups were identified, the respective perceived point sets for each ski resort were revealed on scatter plots, giving a crude impression of the degree of clustering present and the accuracy of the group's overall perception of each resort to its geographic location.

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[1]Alberta Business and Tourism (1976). Ski Industry Evaluation Study. Travel Alberta, Canada.

Examples of these scatter plots are shown in Figures 6 and 7. Figure 6 shows the scatter plots for the variable 'frequency of visit' for Sunshine Village, given by the Calgary sample. Figure 6a shows all those people (n=95) who visit Sunshine Village most often (more than twice a year) and Figure 6b shows those (n=25) who only go skiing at this resort once a year or less. Despite the difference in the number of respondents in each group, it is still apparent that there is a much greater degree of clustering and accuracy in Figure 6a than in Figure 6b.

Where Figure 6 illustrates how the perceptions of distance may differ between the strata of a given variable group for one resort, Figure 7 shows the same stratum of a variable for two different resorts. Figure 7a shows a considerable amount of clustering and locational accuracy for the variable 'frequency of visits' at the 'visits once a year or less' stratum for the resort of Fortress Mountain. Figure 7b shows the same variable, but this time for Fernie. The difference in the configurations of points is immediately obvious and in this example, the number of points in each figure is almost identical (n=115 and n=114 respectively). A rough visual interpretation of the plots shown in Figures 6 and 7 may tell us that those people who ski more often have a better perception of relative location than those who go less frequently. Since Fortress Mountain is only 112Km from Calgary and Fernie is 322Km, it may be concluded that the error found in people's perception of

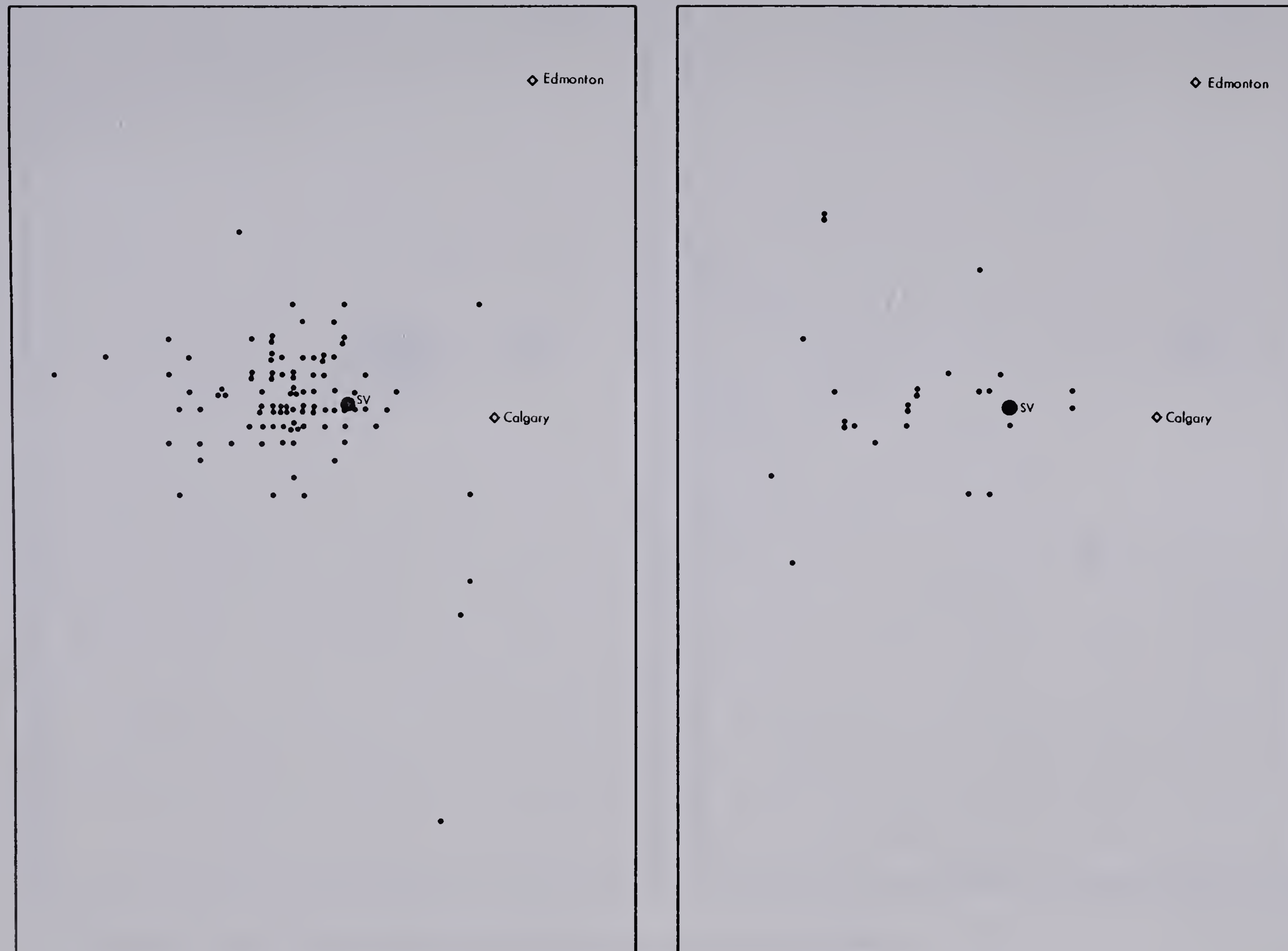

FIG. 6. The Perceived Locations of Sunshine Village by the Variable Groups a) 'frequent visits' and b) 'non-frequent visits'

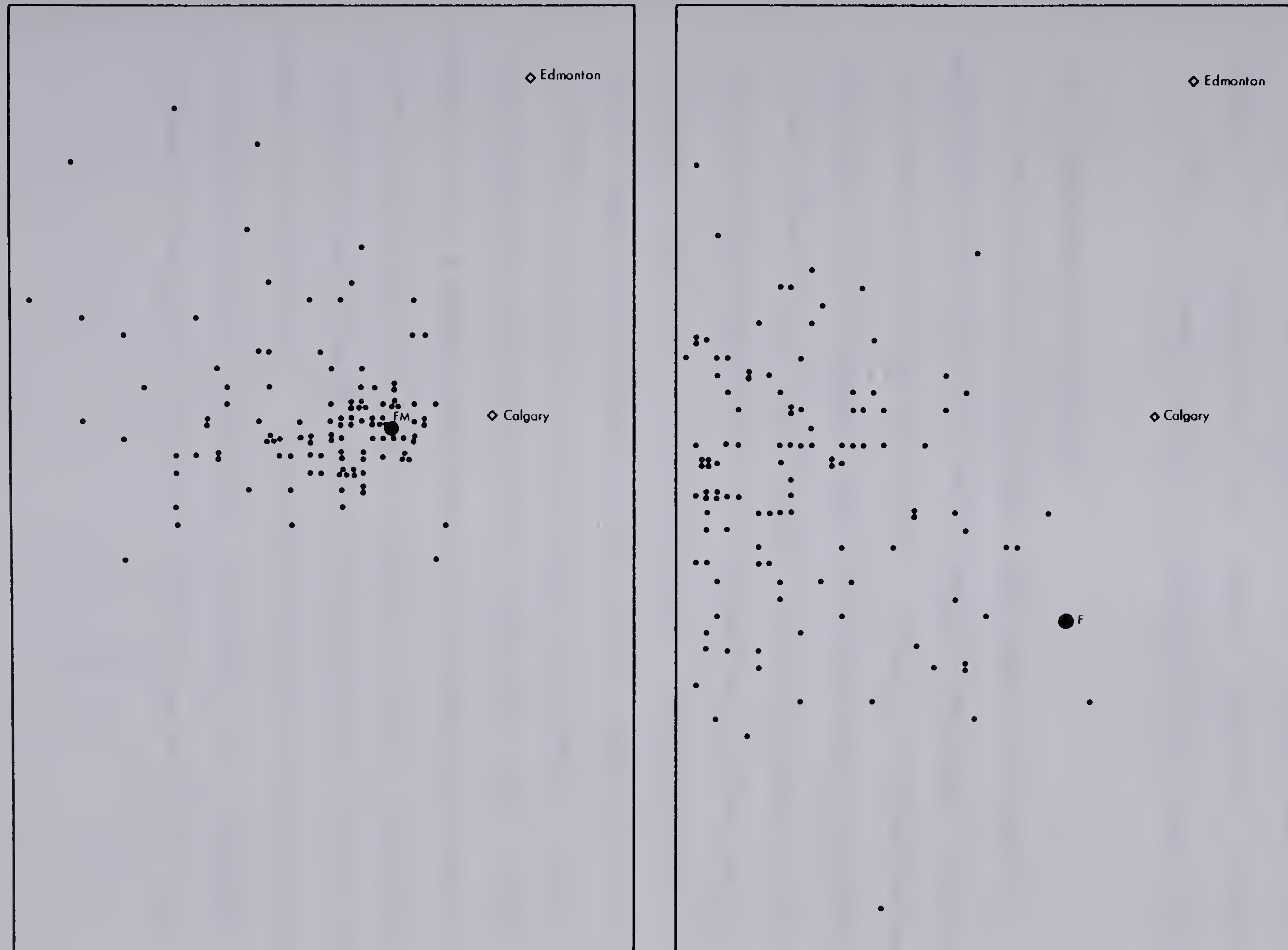

FIG. 7. The Perceived Locations of a) Fortress Mountain and b) Fernie by the Variable Group 'non-frequent visits'.

locations may increase rapidly with distance from the original perception point.

However, these findings are of limited use and are only apparent in the more obvious cases. Therefore, a means of statistically describing the configurations must be found.

4.2.2 Methods of Analysis

The analysis techniques described are aimed at measuring the amount of error present between the perceived and actual locations of the ski resorts. The perceived locations of the resorts were recorded from the mental maps in the form of x,y coordinates. The most common method of measuring point patterns is a technique called nearest neighbour analysis, which determines the amount of clustering or randomness of the points. When the distribution of points is related to a central point, then centrographic techniques may be employed. Neft claims that measures of average position and of dispersal about a centre point constitute the basic elements in an "integrated and internally consistent system of statistical analysis for areal distributions".[2] The most frequently used measures are the mean centre (or centroid), the mean (or standard) distance, the median distance and the mean direction.

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n} \quad ; \quad \bar{Y} = \frac{\sum_{i=1}^{n} Y_i}{n} \qquad (1)$$

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[2]D.S. Neft (1967). Statistical Analysis for Areal Distributions. Monograph No. 2, Regional Science Research Institute.

4.2.3 The Mean Centre or Centroid

The mean centre (c) is the gravitational centre of a group of points and can be expressed as:

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n} \quad ; \qquad \bar{Y} = \frac{\sum_{i=1}^{n} Y_i}{n} \tag{1}$$

where x and y are the coordinates of the individual points in the distribution pattern and n is the total number of points. By calculating the mean centre for each variable group, the average perception point for each group may be located. These points are later used as input to the Bidimensional Empirical Tranformation Program developed by Tobler, in order to show the overall distortion in the mental maps of each variable group.[3] They are also used in an iterative procedure which determines how much each variable contributes to the overall error in the mental maps of each resort. The centroids of each variable are ranked according to distance from the origin so that the most distant point assumes rank 1 and the nearest has a rank of N. The point ranked 1 is subtracted first from the sum of all the points (x's and y's) and the mean recalculated. Rank 2 is subtracted next and again the mean is recalculated. This procedure is followed systematically until the last point is arrived at. The procedure may be written:

$$\frac{\sum X - X_1}{n} = \bar{X}_1 \; ; \qquad \frac{\sum X - X_2}{n} = \bar{X}_2 \cdots\cdots ; \qquad \frac{\sum X - X_n}{n} = \bar{X}_n$$
$$\frac{\sum Y - Y_1}{n} = \bar{Y}_1 \; ; \qquad \frac{\sum Y - Y_2}{n} = \bar{Y}_2 \cdots\cdots ; \qquad \frac{\sum Y - Y_n}{n} = \bar{Y}_n \tag{2}$$

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[3]W. Tobler, (1976). Bidimensional Empirical Transformation Program. University of Michigan.

The method can be used for all the points and for the individual cities. By plotting the resultant points, it can be seen how much each variable contributes to the error. However, because no variable centroid is located at the actual centre, a certain amount of unexplained error still remains. The problem of unexplained error will be expanded upon in the discussion of the results.

4.2.4 The Mean Distance

The mean or standard distance has been widely used in the field of spatial analysis using geostatistical series.[4] It has been used to show both the distribution or location of a phenomonen over a territory or region, and to show movement. By using mean distance measures rather than other measures of dispersion on the point series, certain advantages can be enjoyed: it may be easily defined in a number of ways; it has certain properties that can be manipulated algebraically; it is relatively easy to calculate and importantly, it enables us to analyze separately the factors which influence the distribution of points on the mental maps. Another attraction of the standard distance measure is that it is analagous to the standard deviation used in numerical analysis. Just as in conventional statistics, about two-thirds or 68% of all the points in a normally distributed data set should fall within

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[4]See for example R. Bachi, (1962). "Standard Distance Measures and Related Methods for Spatial Analysis". <u>Papers of the Regional Science Association</u>, 10, 83-132, Zurich Congress.

a circle whose radius is equal to one standard deviation, or in this instance, is equal to the standard distance. The data were tested for normality in this way and it was found that at least 68% of the points fell within a circle whose radius was equal to the standard distance.

The standard distance indicates the distance between any point (p) and the actual centre (a), given by:

$$d_{pa} = \sqrt{(X_p - X_a)^2 + (Y_p - Y_a)^2} \tag{3}$$

If the mean centre (c) were to be used in place of the actual centre (a), then (3) can be rewritten in the form:

$$d_{pc} = \sqrt{(X_p - X_c)^2 + (Y_p - Y_c)^2} \tag{4}$$

We may thus define standard distance as the average of distances from the actual centre

$$d = \frac{\sum d_{pa_i}}{n} \tag{5}$$

or from the mean centre

$$d = \frac{\sum d_{pc_i}}{n} \tag{6}$$

When a perception point (i) is located close to the actual centre, it is seen to represent a more accurate perception than one which is further away (j) which shows less accurate perception. The degree of accuracy can be regarded as perceptual error (e), so that $e_i < e_j$. Thus the standard distance can also be termed the <u>mean error</u> of the variable group.

In order to test the effect of distance on people's perceptions, the mean error may be plotted against actual distance and against ranked error. These graphs may also indicate the effect of political and physical barriers on perception.

4.2.5 Median Distance

In some instances, the mean may be misleading; when very extreme perceptual error is found within the variable group, the mean distance measure may be 'pulled' outwards towards the extreme point or points, and the result may not be representative of the majority of cases. To overcome this problem, the median can be used. The median finds the .05 probability quantile, or the middle value, from the set of distances calculated from (2), thereby eliminating the effect of the extreme values on the rest of the data. This effect can be seen when the mean and median values are compared; the median is lower than the mean for more grouped point series, but higher when the points are widely dispersed.

4.2.6 Mean Direction

The description of a geographical distribution requires not only a measure of dispersion, but also some indication of direction and location. Figure 10b for example, displays a strong directional bias which the standard distance, expressed as a circle, does not describe.

The mean direction of a set of points is not as easily calculated as the mean distance. Take a perceived point (p) which has a set of x,y coordinates which are distinct from the actual centre (a) which has coordinates of x and y . The average of the angles of all points (p) will not yield the mean direction. Therefore the direction of the points has to be measured in radians. Radians are advantageous because they are an absolute measure and do not depend upon dividing the right angle into any arbitrary number of equal parts, such as 90°. A radian therefore is a constant ratio of the circumference of a circle to its diameter. The x,y coordinates are converted into radians by:

$$p = \arctan\left(\frac{x_a - x_p}{y_a - y_p}\right) \qquad (7)$$

and the mean direction of all the points can be expressed as:

$$\text{mean angle } (\bar{L}) = \arctan\left(\frac{\sum_i \sin\alpha}{\sum_i \cos\alpha}\right) \qquad (8)$$

This measure together with the mean distance can be plotted as a vector, using the actual centre as an origin. For each resort therefore, all the variables may be represented by a set of vectors. If all the vectors trend in one particular direction, then there is high group agreement. As the vectors become more fanned then it can be said that there is less agreement. One method of measuring the amount of agreement or clustering of vectors is to derive the sine and cosine of the set of points in a similar

fashion to that described above:

$$\sin \theta = \frac{x}{\sqrt{(x^2 + y^2)}} \quad \text{and,} \quad \cos \theta = \frac{x}{\sqrt{(x^2+y^2)}} \tag{9}$$

The deviation of the vectors around the means of sin θ and cos θ can then be expressed as the root mean square error (RMSE) or deviation of that set of points, such that

$$R.M.S.E = \sqrt{\left[\frac{\Sigma (x - \bar{x})^2}{n}\right]} \tag{10}$$

4.2.7 The Bidimensional Regression Program

The above measures deal with the direction and the distance of sets of points from the given centre. Although these measures indicate that there are varying degrees of distortion present in the data, they refer to one point at a time, and do not provide a picture of the total distortion for all the study area. The Bidimensional Regression Program computes a continuum of deviations for the entire study area, inferring from the deviations between the actual centres and the mean perceived centres.

The Bidimensional Regression Program developed by Tobler is comparable to Pearson's Product Moment Correlation and simple least squares regression procedures except that instead of paired one-dimensional observations of the form x_j and y_j, one has paired locations of the form x_j, y_j ; u_j, v_j .[5]

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[5]W. Tobler. (1976). op. cit., footnote 3.

From these paired couples, one can compute a spatial correlation.[6]

The Program is used in the present context to compute the amount of agreement (or distortion) in the mental maps of different variable groups. The Bidimensional Regression Program converts all the points into cartesian coordinates to specify two configurations representing the geographic location and the perceived location. The objective is to use least squares methods to describe analytically the deviations between the two configurations, such that the residual between the function describing the map and the map itself is reduced to a minimum. Instead of the laborious comparison of the distance and direction of each individual point to its origin on the mental maps, the program makes the comparison of maps a much simpler task, since all one needs to do is to measure the magnitude of the transformation involved from one map configuration to another.

The data used as input to the program consists of the x,y coordinates of the actual centres and the x,y coordinates (given from now on as u,v coordinates) of the centroids for each variable group. The intent is to find out the amount of distortion (or agreement) present in the 'average' mental map of each variable group. The mapping therefore can be considered as a regression from one plane

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[6]W. Tobler, (1965). "Computation of the Correspondence of Geographical Patterns". Papers of the Regional Science Association, 15, 131-139.

(x,y) to another (u,v) which can be fitted to a linear model by using bivariate real functions:

$$\hat{u} = f(x,y) \quad \text{and} \quad \hat{v} = g(x,y) \tag{11}$$

where the circumflex denotes an estimate and where f and g are not independent. The method adopted in this program begins by positioning a square lattice or grid of equally spaced mesh points over the region of concern. The problem is to assign values to the grid matrix from the points. This is done by linear interpolation. The size of the lattice determines the degree of resolution of the fitting procedure; the coarser the grid, the greater the error and the root mean square error (RMSE) value increases; the finer the grid, then less unexplained error is present and the RMSE value decreases. Then a procedure is adopted which finds a function that best fits the distortion given by the $\hat{u},\hat{v}$ values. The mapping function $(x,y) \rightarrow (\hat{u},\hat{v})$ is defined everywhere in the frame. The least squares estimate of the relation between the coordinates is:

$$\begin{pmatrix} u \\ v \end{pmatrix}_{est} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} a_{13} \\ a_{23} \end{pmatrix} \tag{12}$$

This transformation equation is then used to find $(x,y) \rightarrow (\hat{u},\hat{v})$ and the inverse relations of $(\hat{u},\hat{v}) \rightarrow (x,y)$ which approximates from the best fit, back to the original image. A polynomial is approximated for the entire surface of $\hat{u},\hat{v}$, given x,y. The best fit is where a plane derived from the above equation, passes through all the points. Usually the best fit only approximates towards a full explanation of the

error of 100%.

There are several measures of the total distortion. Maximum, minimum and average values of stretching, a total distortion value, a stress value which results from the residuals of the least squares fitting procedure and the median error values, these measures can be tabulated and compared in order to test the hypotheses relating to each of the variables. In addition to these numerical indices of error, visual portrayals of the distortion present are given by a warped grid which shows the geographical displacements of the centroids. The effect of locational distortions can be seen when the boundaries are plotted separately, and the specific areas of distortion are shown in an isoline map which contours the amounts of distortion over the map.

5. DISCUSSION OF THE RESULTS

5.1 Testing the Hypotheses

The aim of the thesis as set out in Chapter 1 is to explain the error of the perceived locations in terms of within-group similarities and between-group differences. The hypotheses set down below are structured so as to fulfill the aims of the thesis. The following set of measures will be used to test the hypotheses:

(1) The difference in size from the 'before' of actual triangulation to the 'after' triangulation. The original triangulation (Figure 8a) is the connection of all the geographic locations of the resorts by lines such that they form triangles with no intersecting lines, that is, monotonic. The 'after' triangulation shown in Figure 8b shows a triangulation connecting the same points as in Figure 11a but this time the locations of the points are distorted. This distortion forces the lines to intersect and therefore monotonicity is violated and the size of the triangulation changes. The distortion revealed by the two triangulations may be shown by counting the violations of monotonicity, counting the number of extra triangles, or by looking at the per cent increase or decrease in size of the two configurations. The latter method was found to be the most sensitive to variations in distortion;

(2) and (3) are the average maximum and average minimum stretch values obtained from Tissot's elipses (see Figure

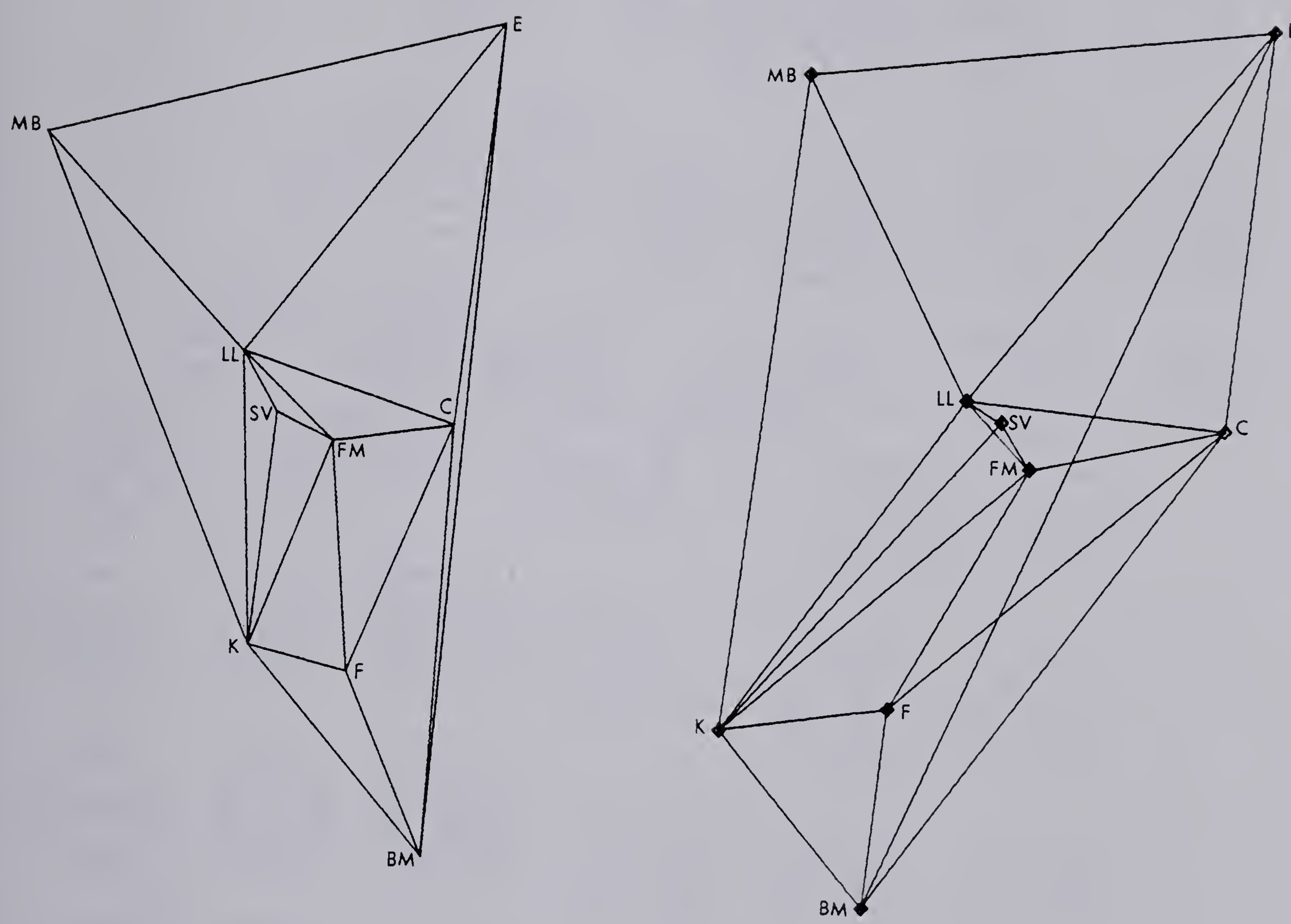

FIG. 8. The 'Before' and 'After' Triangulations.

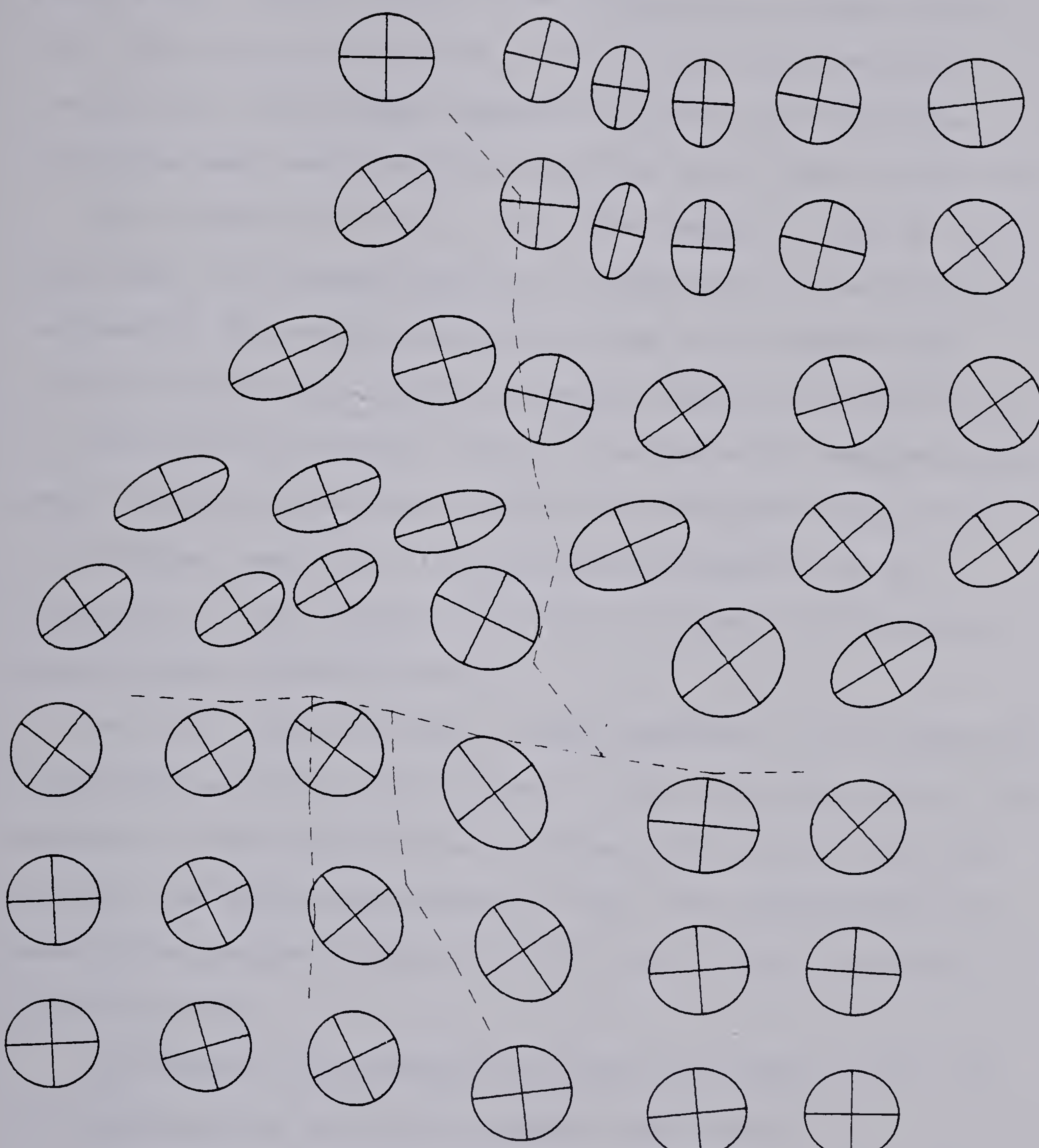

FIG. 9. Tissot's Elipses.

9). The elipses represent the amount of distortion present at each intersection of the grid or mesh which covers the study area. The two axes of the elipses are aligned such that the a axis is oriented in the direction of maximum distortion. The average length of all the 'a' axes thus gives the mean maximum stretch of the grid. The 'b' axis is at right angles to the 'a' axis. The length of the 'b' axis describes any secondary pull or stretching of the grid and represents the minimum stretch of the grid. Higher mean values on both axes denotes a greater amount of distortion;
(4) the total distortion. This is estimated by measuring the amount each intersection of the distorted grid moves from its original position. It can be used therefore as an indicator of the overall distortion present in the mental maps of each variable group;
(5) the final measure used to test the error is not derived from the transformation program as were the other four. This measure is the median error which was calculated from the data by the method explained in 4.25. The median error is merely the median distance of all the x,y coordinates of a given variable.

The above five measures of error are used to test the following set of null and research hypotheses:

1. H_0 - There is no difference between variable x and variable y.
2. H_1 - There will be consistent differences between variables.

3. H_0 - There is no difference between the Edmonton and Calgary samples.
4. H_1 - The Calgary sample has less perceptual error than the Edmonton sample.

The five variables discussed in the literature review and derived from the data, are used in these and in subsequent discussions: 'visits' which is whether a person has visited a given resort or not; 'frequency of visit' which is self-explanatory; 'experience' which incorporates both the number of years skiing experience and ability; 'sex' which is also self-explanatory; and 'residency' which is the length of residency of the skier in either origin city.

The data are in aggregated form because the interest lies in looking at the way perceptual error changes over different variable groups. The tests therefore look at between-variable differences and between-city differences. That differences are discernible can be seen by the general rejection of the null hypotheses (see Table 9). In other words, there are differences in the amount of error found in the mental maps, depending on the variable and the origin city, although for the latter, there are three occasions when there is no difference in the error. Whether the distinctions accord with the expectations can be seen by testing the research hypotheses. Table 9 shows that there is a greater acceptance of the research hypothesis

TABLE 9. THE NUMBER OF TIMES H_o IS REJECTED AND H_i ACCEPTED BY THE ERROR MEASUREMENTS.

	Visits	Frequency	Experience	sex	Residency
*H_o(1) there is no difference between variables					
- Edmonton and Calgary	5	5	5	5	5
- Edmonton	5	5	5	5	5
- Calgary	5	5	5	5	5
H_i(2) there is a difference between variables					
- Edmonton and Calgary	3	1	4	1	3 (2)+
- Edmonton	4	1	5	2	2
- Calgary	3	1	3	1	3 (2)
H_o(3) there is no difference between cities					
- all variables	5	5	4	5	5
- have not visited	5				
- have visited	5				
- frequent		4			
- infrequent		5			
- inexperienced			5		
- experienced			5		
- male				5	
- female				5	
- resident less than one year					5
- resident 2 - 10 years					4
- resident more than 10 years					5
H_i(4) there is a difference between cities					
- all variables	3	2	1	3	3
- have not visited	3				
- have visited	0				
- frequent		1			
- infrequent		3			
- inexperienced			1		
- experienced			2		
- male				0	
- female				5	
- resident less than 1 year					0
- resident 2 - 10 years					4
- resident more than 10 years					4

* See page 62 for full hypotheses statements

\+ 2(4) means that H_i is supported fully 2 times and partially four times. This occurs for RESIDENCY only because there are three categories.

concerning between-variable differences than of the hypothesis which suggests that the Calgary maps will contain less error than the Edmonton maps. This fact seems to indicate that the variables contribute more to the explanation of perceptual error than the place of origin. This is especially true in the case of 'visits' and 'experience' where H_1 is supported ten and twelve times respectively out of a possible fifteen (Table 9). The results seem to imply therefore that those people who have visited a resort and those with greater skiing experience consistently have less perceptual error than those who have never visited the resort and who have less than five years skiing experience. This finding is in accordance with the literature reported in Chapter 2 where it was seen that 'visits' and 'experience', grouped collectively as 'familiarity' have a strong bearing on the formation of perceptions.

Differences in perceptual error resulting from sex distinctions is not as great as was expected, and in some cases women have less perceptual error than men. For women however, the city of origin appears to be important in determining perceptual error; in all measures of error, Calgary women (Table 9) have less perceptual error than Edmonton women. It appears that the distance factor plays an important part in this distinction; the distances are so short (comparatively) that 86% of all trips from Calgary to Lake Louise,

Sunshine Village and Fortress Mountain are day-trips which encourages women to make more trips than Edmontonians (37, 20 and 24 per cent more trips respectively). In addition a substantially larger number of women drive their own cars to the resorts (45% as compared to 26%). This distinction conforms with Beck and Wood's postulation that differences in perceptions by women is role-related rather than as a result of the sex itself (Chapter 2). Therefore driving one's own car as opposed to being driven, could account for their more accurate perception of the distances involved.

As might be expected, a resident in Calgary has a more accurate perception than an Edmontonian, but the variations in length of residency are not as obvious (Table 9). It was expected that perception would become more accurate with length of residency. While this is true for the nearer resorts, it is not always the case for the more distant resorts, where the situation tends to be reversed (Figure 10): the newer residents perceive the location of the resorts better than medium length residents, who in turn are more accurate than life-time residents. An explanation may lie in the fact that newcomers are more spatially aware of the location and geography of the region to which they have come, than long-term residents who have had time to build up erroneous perceptions based on a life-time's experience.

Although Calgary skiers make 12 per cent more

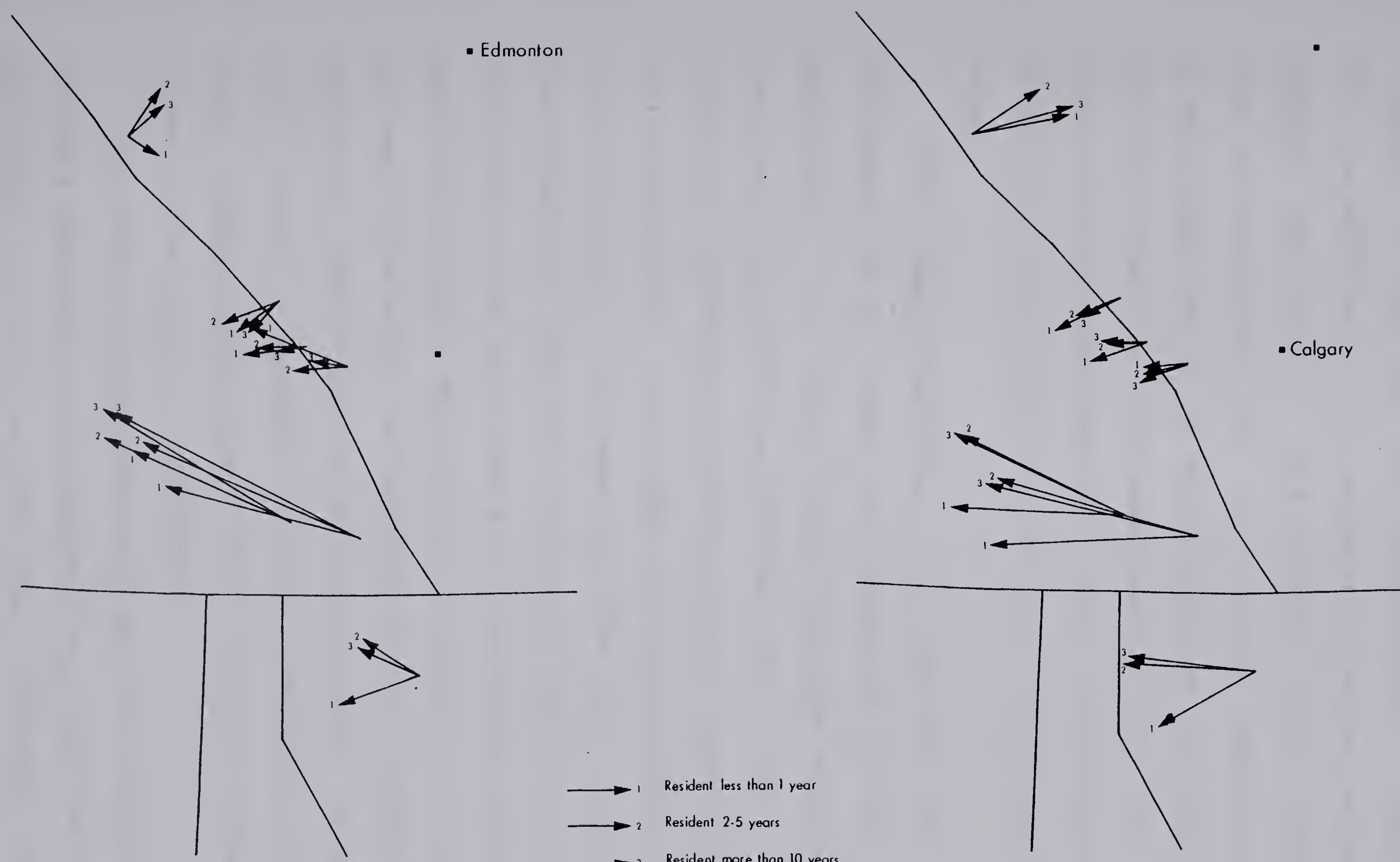

FIG. 10. Centroids for the Variable 'Length of Residency'.

frequent ski trips than their counterparts in Edmonton, their perceptions are not necessarily better as the H_1 suggests (see Table 9). That frequent Calgary skiers have less perception error than frequent Edmonton skiers is only supported by the measurements on one occasion and even between-variable measurements do not fully support the research hypothesis that a more frequent skier has less perception error than a less frequent skier.

In the above discussion, it is apparent that the hypotheses are not always fully supported by the measurements, but Table 10 shows that some measures yield more consistent results than others. Total distortion, maximum and minimum stretch values yield fairly successful results when looking at variables and city differences. This means that the results support the contentions that one variable will be less erroneous than another and that Calgary will have more accurate maps than Edmonton. Median error is supportive in all but one instance for the variables but only supports the hypothesis concerning city differences once. The per cent increase or decrease in size of the before and after triangulations gives little supportive evidence to either of the research hypotheses.

The above findings show that variable differences are more important to the explanation of the overall perceptual error (all resorts) than differences in

TABLE IO. ABILITY OF THE ERROR MEASUREMENTS TO SUPPORT THE HYPOTHESES (H_i).

	All Cases*	Between-Variables	Between-Cities+	Total
Difference in size of triangulations	2	2	5	9
Median error	6	9	1	16
Mean maximum stretch	5	5	6	16
Mean minimum stretch	6	4	6	16
Total Distortion	5	5	5	15

* The maximum possible support for H_1 for All Cases and Between-Variables is 10.

+ The maximum possible for Between-Cities is 11 and the Total maximum is 31.

origin city. The next issue considered, is how do the individual variables contribute to the mental maps of each resort.

5.1.1 Explanation of Error

Testing the hypotheses for all the varaibles irrespective of resort, revealed that city differences did not affect perceptions as much as variable differences. However, when the maps derived from the centroids of each resort are examined, city differences (in effect, distances) become more apparent. The following maps and tables are obtained from the results of the iterative procedure described in section 4.23. It must be remembered that the centroids were ranked according to error, and then by using an iterative process, the most erroneous point was subtracted from the mean of all the other centroids and the mean recalculated. In effect therefore, the mean perceived centre 'moved' towards the actual centre. The variables in Table 11 are ranked from 1 (the most distant or erroneous point) to 22 (the nearest or most accurate point). The between-city differences are clear in the cases of Marmot Basin and Big Mountain, where Calgary variables are generally the most erroneous (see Figure 14). The situation tends to be reversed in the case of Fernie and Kimberley. In the case of Lake Louise, Sunshine Village and Fortress Mountain, the distinction is not obvious and each city contributes equally to the error present (see Figure 15).

TABLE II. DISTRIBUTION OF RANKED VARIABLES BETWEEN CITIES.

* Ranks	Marmot Basin (E)	(C)	Big Mountain (E)	(C)	Sunshine Village (E)	(C)	Fortress Mountain (E)	(C)	Lake Louise (E)	(C)	Kimberley (E)	(C)	Fernie (E)	(C)
1		x	x			x	x			x		x	x	
2		x		x		x	x			x	x		x	
3		x	x			x		x		x	x		x	
4		x		x		x		x	x		x		x	
5		x		x	x			x	x			x	x	
6		x		x	x		x		x		x		x	
7		x		x	x		x		x		x		x	
8		x		x	x		x		x		x		x	
9		x		x	x		x		x	x	x	x		x
10	x	x		x	x		x	x	x		x			x
11	x			x		x		x	x	x		x		x
12	x			x		x	x		x	x		x		x
13	x			x		x	x			x	x			x
14	x		x			x		x		x		x	x	
15	x		x			x		x		x		x		x
16	x	x	x		x			x	x	x		x		x
17	x		x		x			x	x		x	x		x
18	x		x		x	x	x			x		x	x	
19	x		x		x			x				x	x	x
20	x		x		x	x	x					x		x
21			x					x						x
22			x											

* Rank I is assigned to the most erroneous group and rank 22 is given to the most accurate group. In some cases two groups may possess the same amount of error.

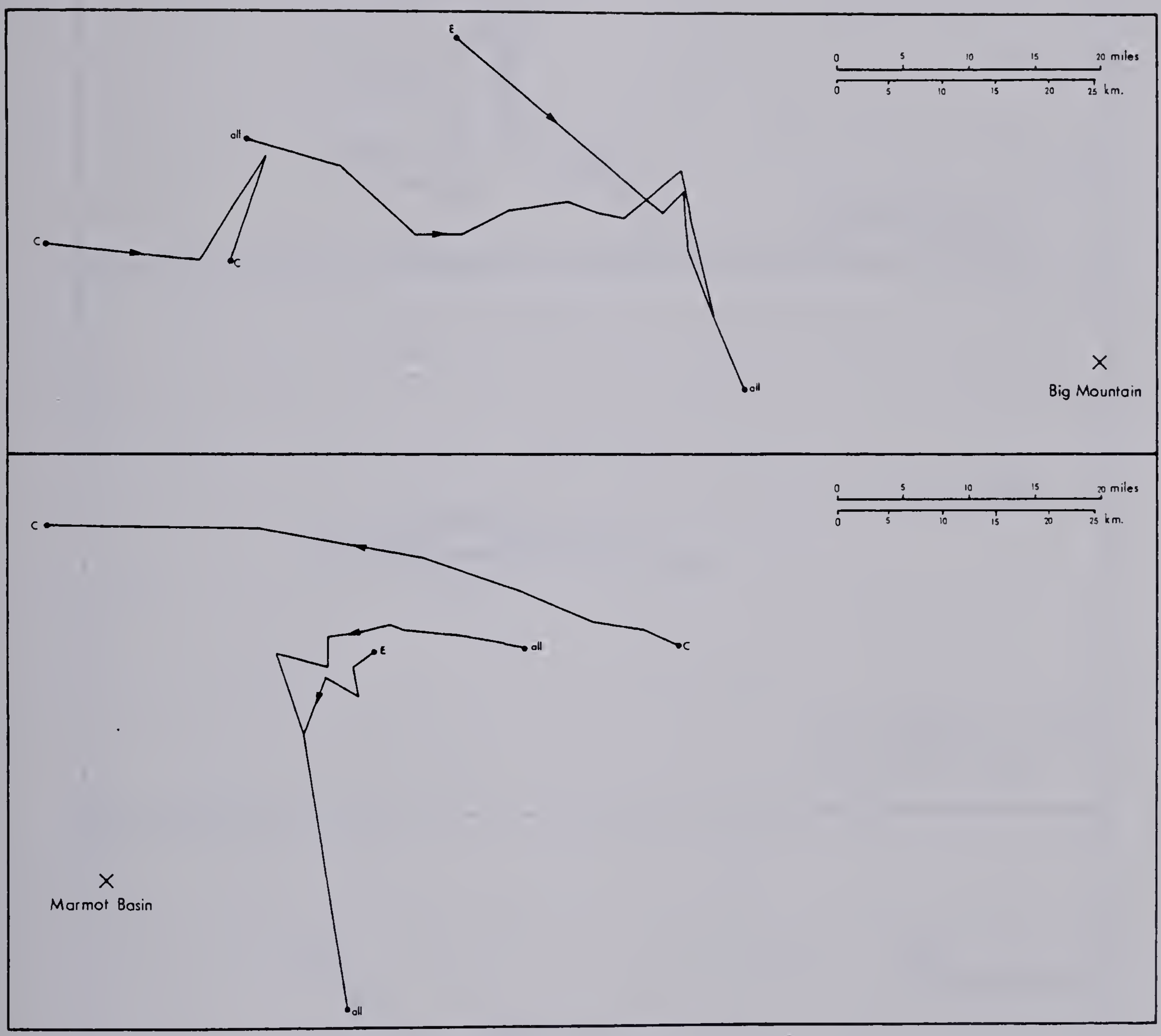

FIG. 11. City Differences in the Identification of Error in the Mental Maps.

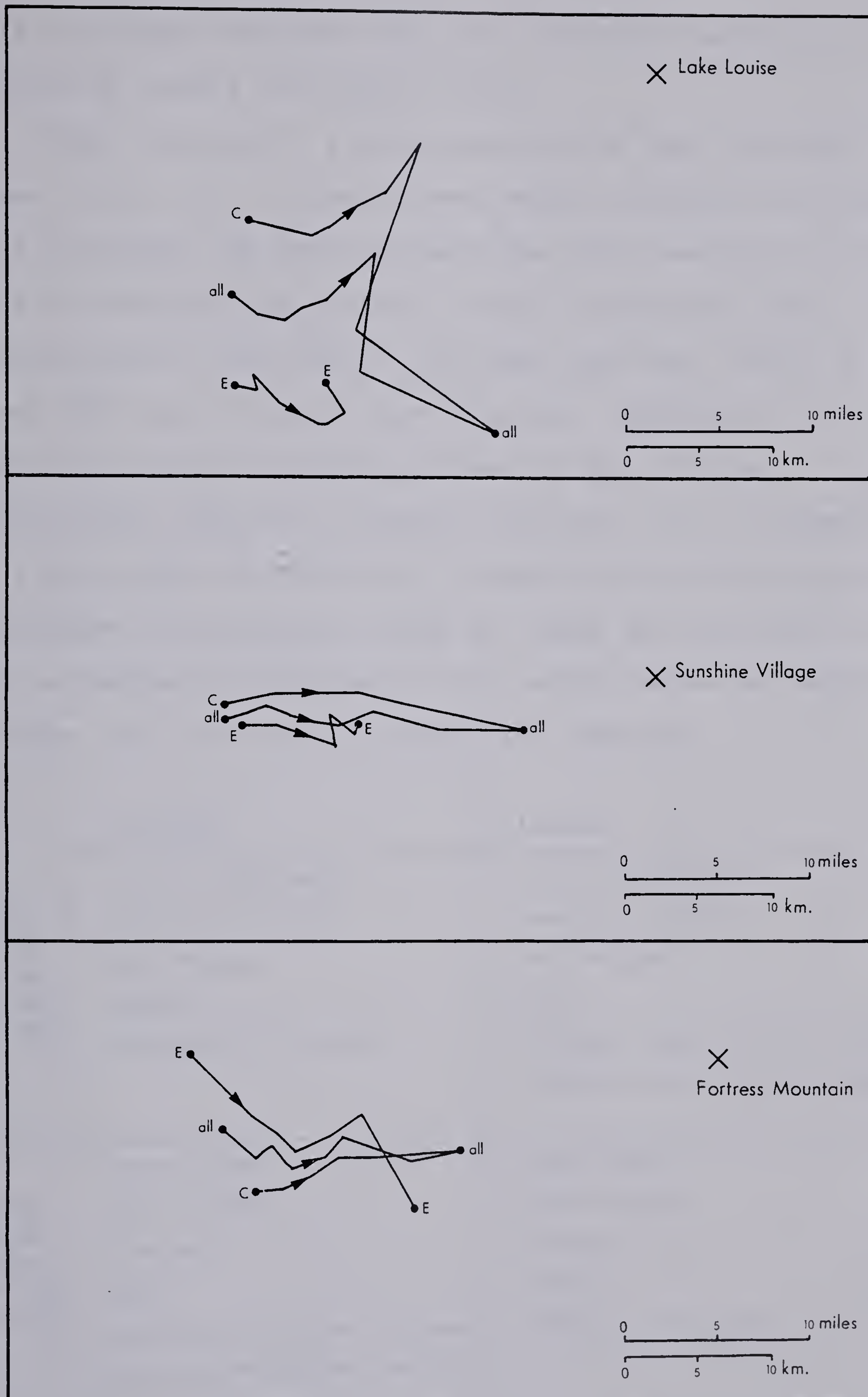

FIG. 12, Equal Contribution to the Error in the Mental Maps by the Two Cities.

This is probably because they are the most frequented resorts by skiers from both cities.

When the overall average position of each variable is found (Table 12), it can be seen which variables are the most erroneous and which promote the least amount of error. This is shown by the rankings, with 1 being the least accurate point and rank 22, the most accurate. Table 12 shows that the variable 'have visited' (Edmonton) is generally the most accurate (rank 22) and 'little experience' (Edmonton) produces the most error. A comparison of Figures 13a and 13b clearly displays the difference in the amount of distortion shown by these two variables. If the variables are divided by city and by below and above average rank, an interesting pattern emerges:

	EDMONTON	CALGARY
Ranks 1-11 (below average accuracy)	little experience have not visited not frequent female resident 2-10 years	little experience have not visited not frequent male resident less than one year resident more than ten years
Ranks 12-22 (above average accuracy)	experienced have visited frequent male resident less than one year resident more than ten yrs.	experienced have visited frequent female resident 2-10 years

TABLE 12. AVERAGE RANKED POSITION OF THE VARIABLES WITH RESPECT TO THE RESORTS.

Variable	Overall Rank	Average Rank
Less than 5 years experience (E), (9)	1*	6.93
Male (C), (15)	2	7.95
Have not visited (C), (3)	3	9.00
1 year or less residence in C, (20)	4	9.29
Not frequent ski trips (C), (8)	5.5	9.50
2 - 10 years residence in E, (18)	5.5	9.50
Female (E), (14)	7	9.64
Have not visited (E), (1)	8.5	9.86
Less than 5 years experience (C), (11)	8.5	9.86
Not frequent ski trips (E), (6)	10	10.43
More than 10 years residence in C, (22)	11	10.50
Frequent ski trips (C), (7)	12	11.00
More than 5 years experience (E), (10)	13	11.29
Male (E), (13)	14	11.36
More than 5 years experience (C), (12)	15	12.07
1 year or less residence in E, (17)	16	12.14
2 - 10 years residence in C, (21)	17	12.21
Have visited (c), (4)	18	12.57
More than 10 years residence in E, 9(19)	19	13.21
Frequent ski trips (E), (5)	20	13.71
Female (C), (16)	21	13.79
Have visited (E), (2)	22	15.14

* Rank 1 is the most erroneous point and rank 22 is the most accurate variable on average.

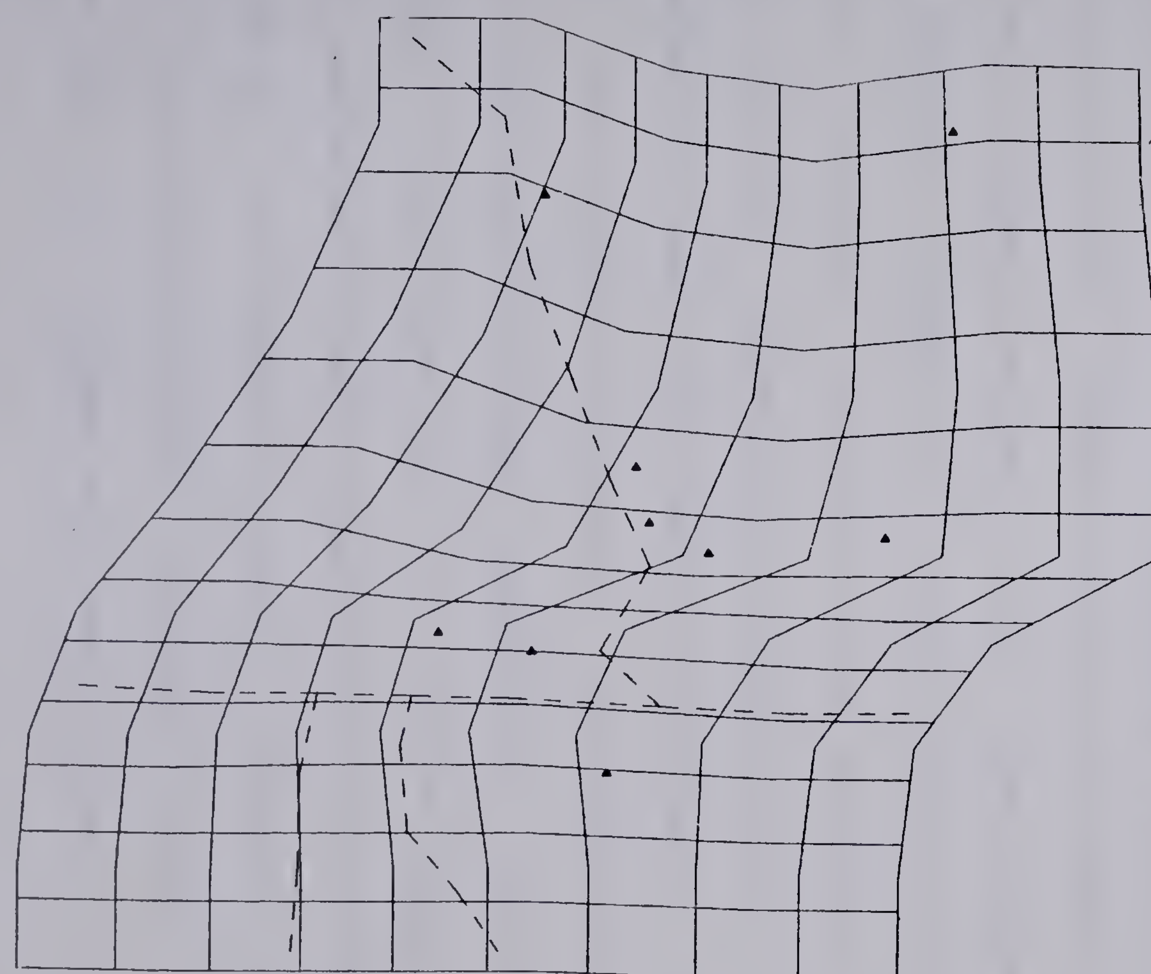

Fig. 13a. Overall Distortion of Study area by 'little experience (Edmonton)'

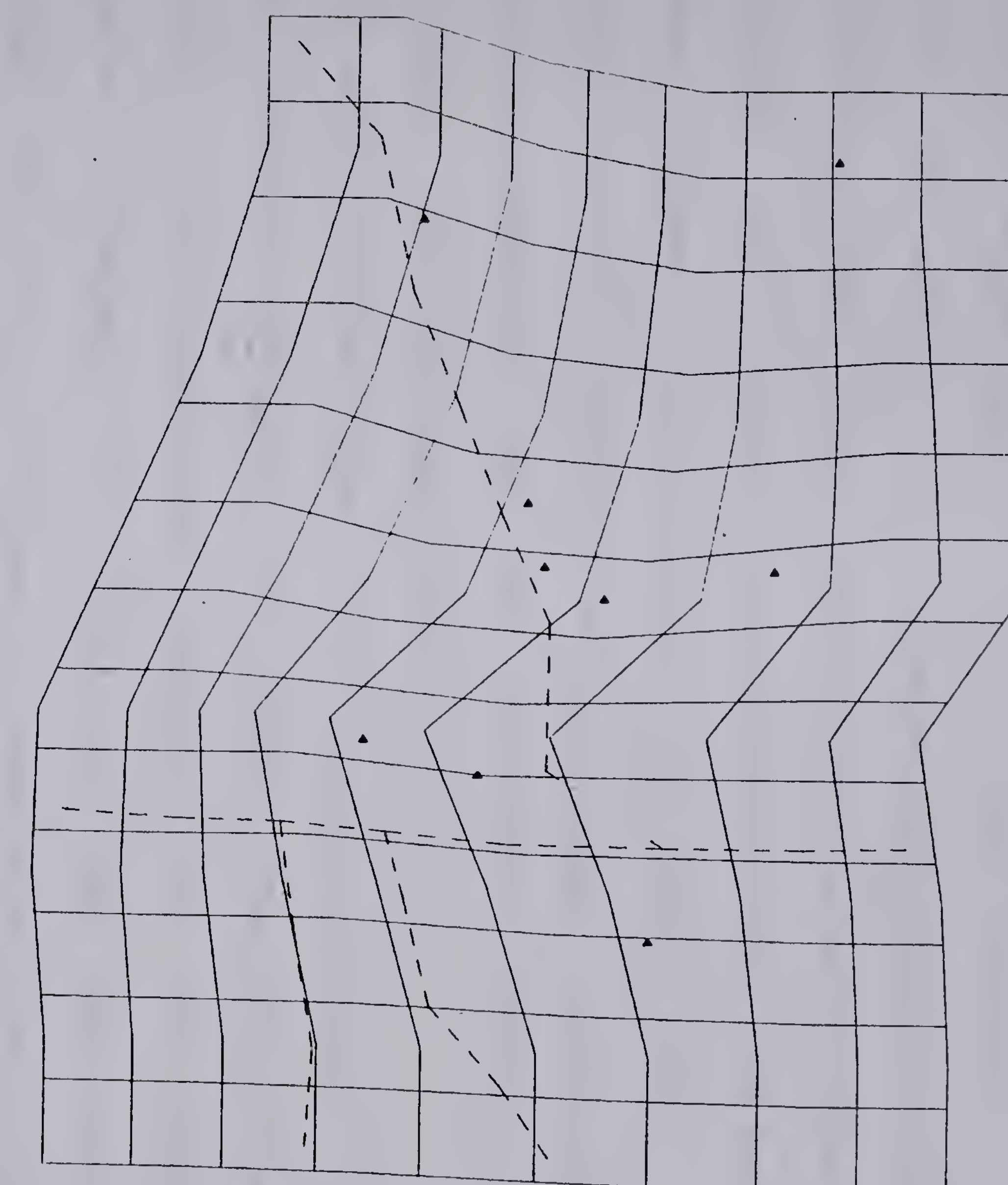

Fig. 13b. Overall Distortion of Study area by 'have visited (Edmonton)'

For the 'experience', 'visits' and 'frequency' variables, the pattern is as expected and supports the research hypotheses: those people who have only a few years skiing experience, have not visited the resort and who do not make frequent visits, perceive the resorts less accurately than the average, and vice versa. As was shown in the previous section, 'sex' and 'residency' variables are less regular and vary according to city.

It appears from Figure 14 that some points are often related, that is, grouped. For example, the groups Edmonton males (9), little experience (Calgary) (15), mid length residents of Edmonton (18) and mid and long time residents of Calgary (21,22) are frequently associated (see Figure 14e,f,g). Others are often scattered, such as frequent Edmonton skiers (5), Calgary males and females (11,12) and short-term Calgary residents (20), (see Figure 14b,c,e,f).

Although finding the average relative position of the variables is useful in ascertaining the overall contribution of each variable, interesting exceptions are hidden. It has been generally seen that people who have not visited a resort, have greater perceptual error than those who have, but for the Edmonton sample especially, there are some exceptions. People who have not visited Marmot and Lake Louise, perceive it more accurately than average (see the location of 1 in Figure 14a and b), possibly because of general experience gained from long residence in Edmonton and the fact that Jasper and Lake Louise are also summer

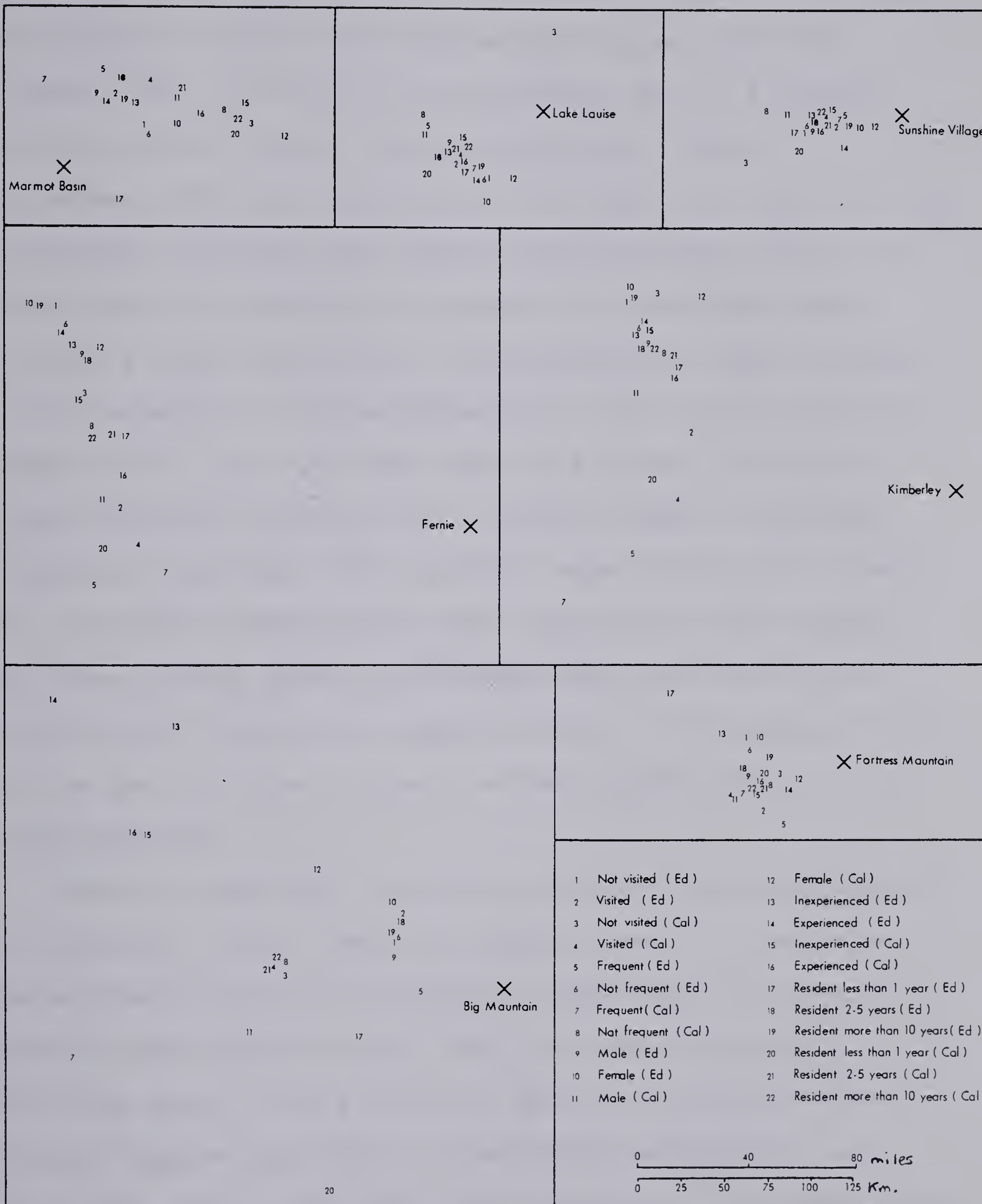

FIG.14. Centroid Locations for a) Marmot Basin ; b) Lake Louise; c) Sunshine Village; d) Fernie; e) Kimberley; f) Big Mountain g) Fortress Mountain

recreation attractions as well as winter resorts. This does not however, explain why Big Mountain is an exception (Figure 14f). Turning to the preference data, it appears that out of all those ranking Big Mountain first in preference, 66% have not actually visited the resort. A high preference therefore may reduce the perceptual error. This point could be reversed to explain why people who have visited a resort perceive it less accurately than average, as for example in Fortress Mountain (Figure 14g, point 2), where 51% of those who have been to Fortress, rank the resort seventh in preference. In other cases, exceptions cannot be explained. The variable 'have visited (E)' (point 2) is overall ranked as the most accurate variable group, why then is that group so mistaken about the location of Lake Louise? There is no apparent answer in the data, which may be due to either 'noise' in the research design or to sampling error.

Many of the other variable exceptions can be explained in terms of 'visits'. Why do Calgary women (12) perceive Marmot Basin and Fernie so poorly (see Figure 14a and d), when for the other resorts, they are the second most accurate group? In the 'visits' data, 71% and 83% of all Calgary females have not visited these two resorts, as compared to only 2 per cent who have not visited Lake Louise and Sunshine Village. Similarly, for Edmonton males (9) who generally rank highly, but the fact that 94% have not visited Fortress may explain why they have less accurate

perception for this resort. In reverse, Calgary women (12) have generally poor perception, but they are the most accurate group for Sunshine Village, possibly because 90% have visited Sunshine, as apposed to only 76%, 66% and 26% for Marmot, Lake Louise and Fortress.

Distance is important in determining the amount a resort has been visited. For Calgary skiers, Marmot Basin is distant which accounts for the low number of people who have visited it (only 30%), and in general why such variables as 'experience' and 'residence' are more erroneous here than for the other resorts (see Figure 14a, points 15, 16, 20-22). Distance is again a factor for Edmonton when the British Columbia resorts are considered: 88 and 80 per cent of life-time residents of Edmonton (19) have not visited Fernie and Kimberley.

Although the number of times a skier visits a resort has not been as important in determining the error as was originally expected, 'frequency of visit' does help explain why inexperienced skiers from Calgary (15) perceive Lake Louise and Sunshine Village so much better than average; 95% and 97% of new skiers have not only visited Sunshine Village and Lake Louise respectively, but also 86% and 66% attend these resorts on a frequent basis. The group of low frequency skiers from Calgary (8) generally has poor perception, but for Big Mountain, they have a more accurate image which again could be due to their preference of the resort, since 69% of this group rank Big Mountain first or

second in their preferences.

In conclusion, while it seems that the less experienced, less frequent skier tends to contribute more to the overall perceptual error than more frequent, experienced skiers, whether a person has visited the resort or not is probably the single most important variable in the explanation of perceptual error.

5.1.2 Distance and Boundary Effects

The alternate hypothesis stated that the Calgary sample would perceive the locations of the ski resorts better than the Edmonton sample. This was expected because of the greater distances involved from Edmonton to the ski resorts. It was seen in section 5.1 that between-city differences do not conform to the hypotheses as well as the variables. An explanation can now be forwarded. Figure 15 is a plot of the mean error for each variable against the distance of each resort from the origin. If perceptual error increased at a constant or even an exponential rate over distance, one would expect that the mean error for Edmonton to be greater than that for Calgary and to be the same at a given distance (Figure 16).

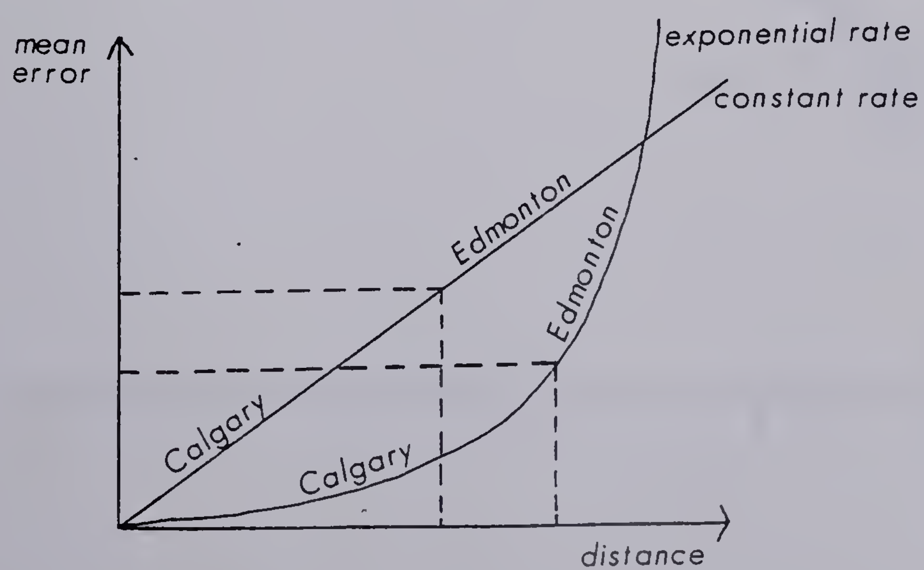

FIG. 16. Hypothetical Relationship between Perceptual Error and Distance.

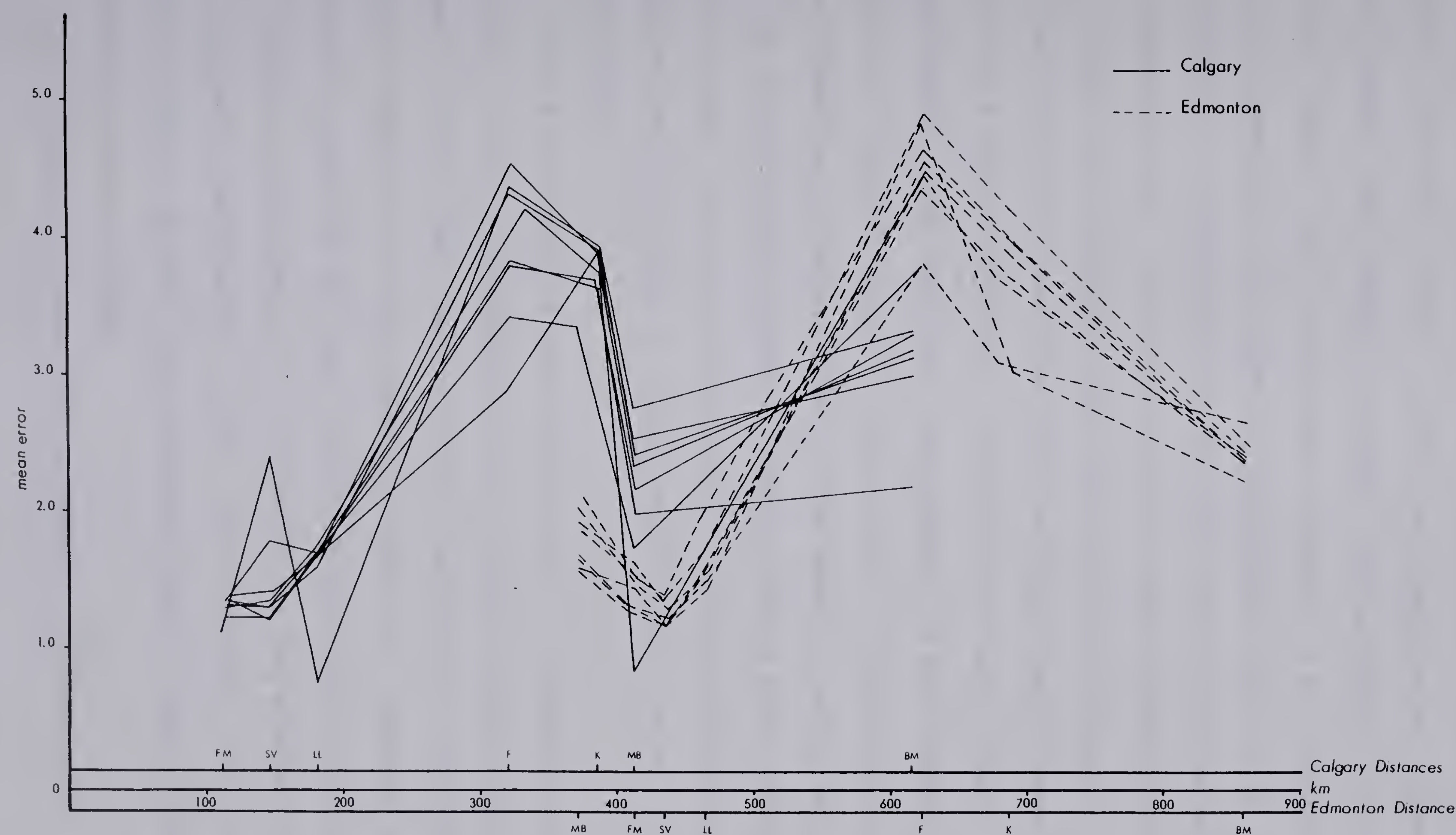

FIG. 15. The Error Variation of Mean Error over Distance.

This does not appear to be the case as Figure 15 clearly indicates. First, at 400 Km. Edmonton has lower mean error values than Calgary. Second, the two peaks are at a similar height, but for Calgary the peak is at 300-400 Km. and for Edmonton, this peak of perceptual error is at 600-650 Km., a difference of 300 Km. with no corresponding increase in error. The third point to make concerning Figure 15 is that the configurations are slightly different. This is due to the fact that the resorts along the distance scale are in a slightly different order for the two cities. Nevertheless, the low error corresponds in both cases to the Albertan resorts - note the sharp drop in the Calgary plot from Kimberley to Marmot Basin. The peaks in error are due to the two British Columbian resorts and in both cases, Big Mountain has less error than both Fernie and Kimberley despite the fact that it is the most distant resort for either city.

The fact that the perceptual error of Edmonton is similar to that of Calgary but for a much greater distance seems to imply that there is such a concept as 'perceptual range'. Edmonton's range spans over 860 Km. compared to Calgary's range of 600 Km. This difference may be attributed to the fact that Edmonton is situated in the middle of a perceptually featureless 'plain', while Calgary lies on the edge of such a 'plain' and has more readily identifiable landmarks close at hand.

It is possible here to contemplate the effect of

boundaries on people's perception. In this study area, there is both a political and physical barrier between the British Columbian resorts and Edmonton and Calgary and a political barrier (albeit a stronger one) between Big Mountain and the origin cities. If we plot the ranked mean error against mean error (Figure 17), the boundary effect becomes clearer. In both graphs the first four points are the Albertan resorts. For Edmonton this is not so surprising since they are the four nearest, but for Calgary, the mean error of Marmot Basin is ranked fourth in all variables, but it is ranked sixth by distance. Although this is the sole example, it seems to indicate that places within the familiar provincial boundaries feel closer than those outside. Indeed the curves of the graphs, which tend to be exponential rather than linear, tend to pivot between the fourth and fifth points (Alberta border), with a sudden increase in error. It would also appear that the physical-political boundary to British Columbia poses more of a barrier on people's perception than the Canada-U.S. border, because in all but four cases (out of twenty-two), Big Mountain is ranked higher (less error) than the closer British Columbian resorts. It can be seen in Figures 18 and 19 that much of the error is concentrated along the boundary zones. Figure 18 shows the positions of the boundaries for each variable for those centroids that were grouped and Figure 19 shows the same for scattered centroids. The angle that the Alberta-B.C. border strikes the U.S. border is considerably steepened; in actuality the

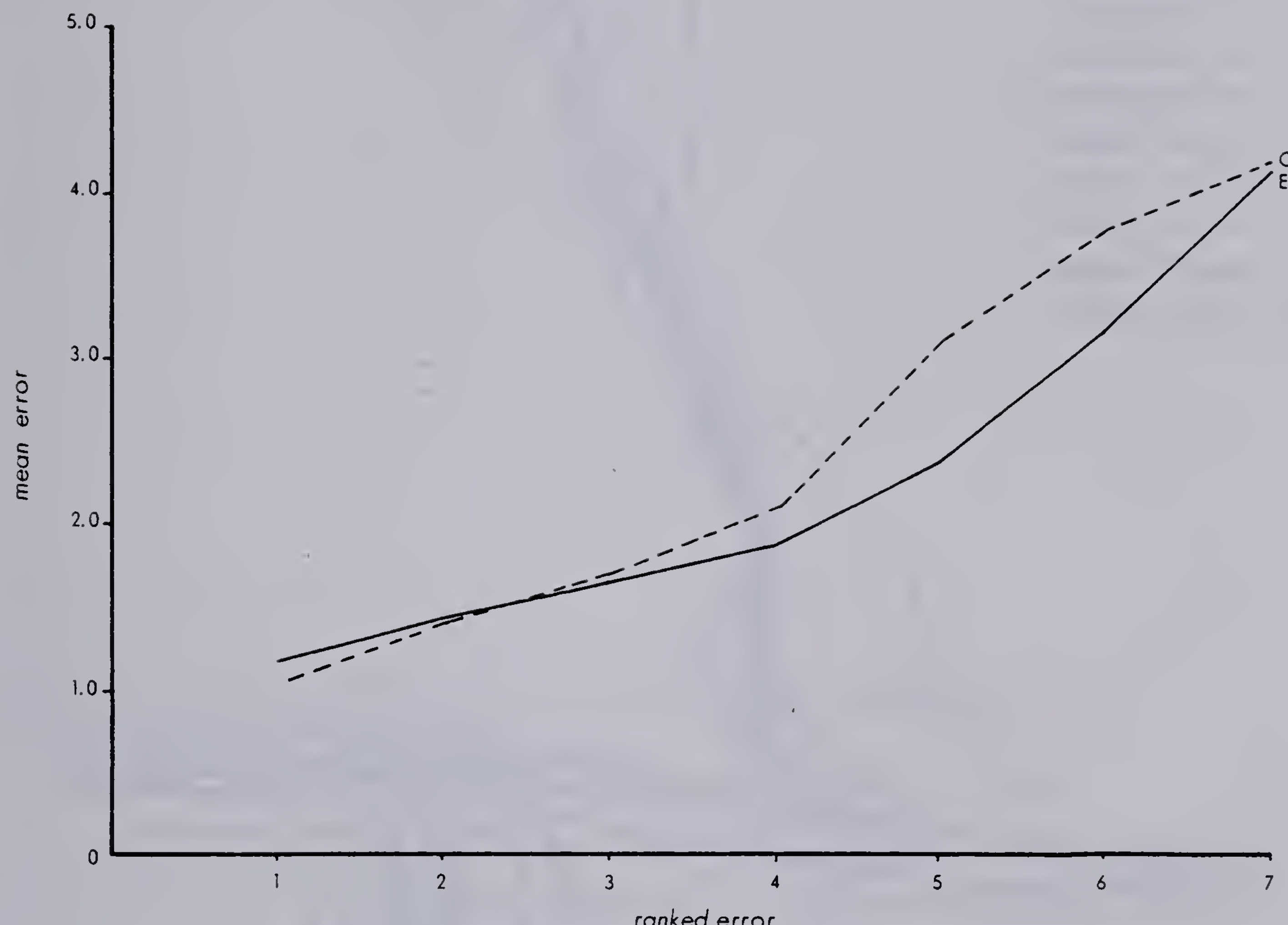

FIG. 17. Graphs Showing Mean Error over Ranked Error for Edmonton and Calgary.

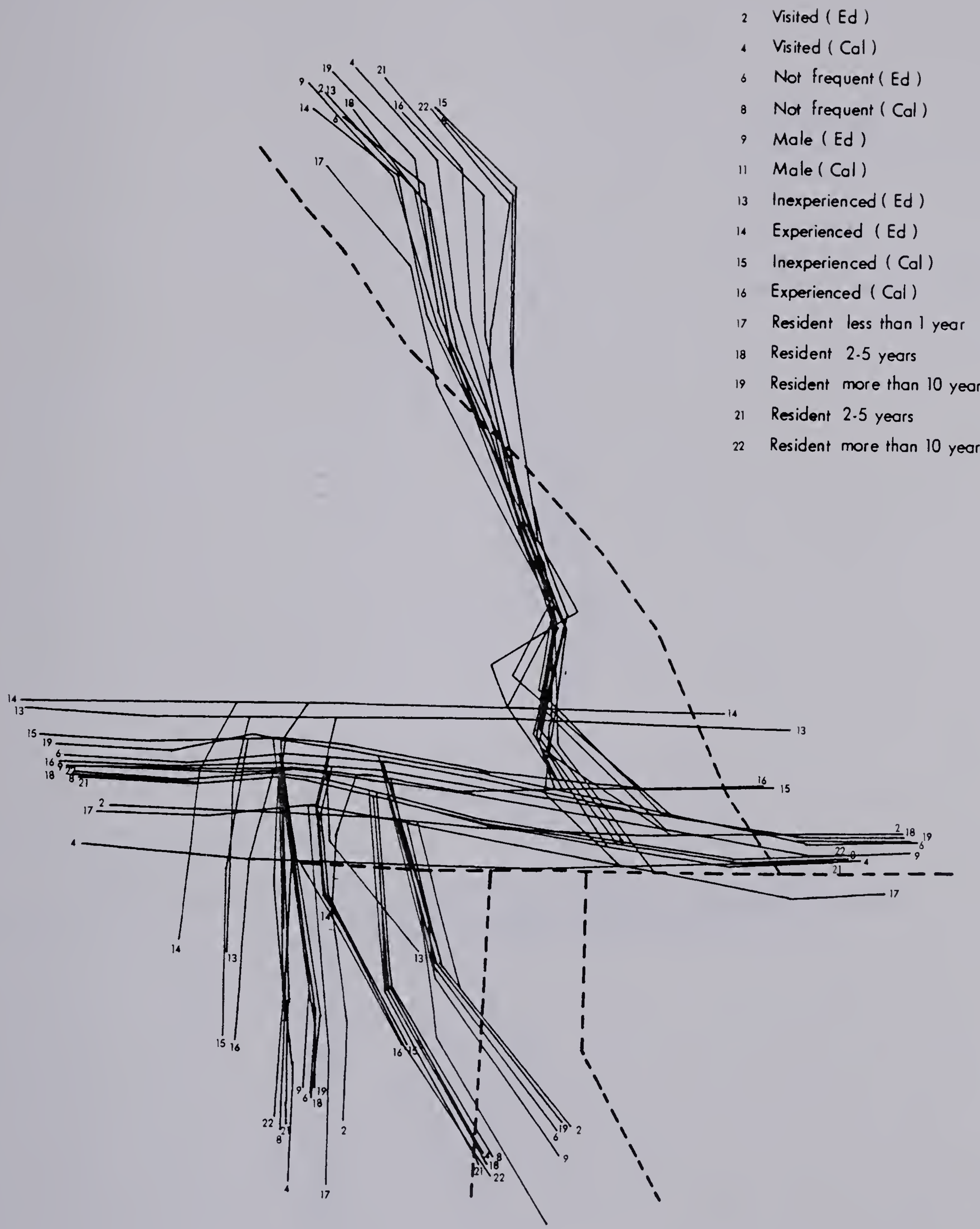

FIG. 18. Boundary Placements for Clustered Variable Groups

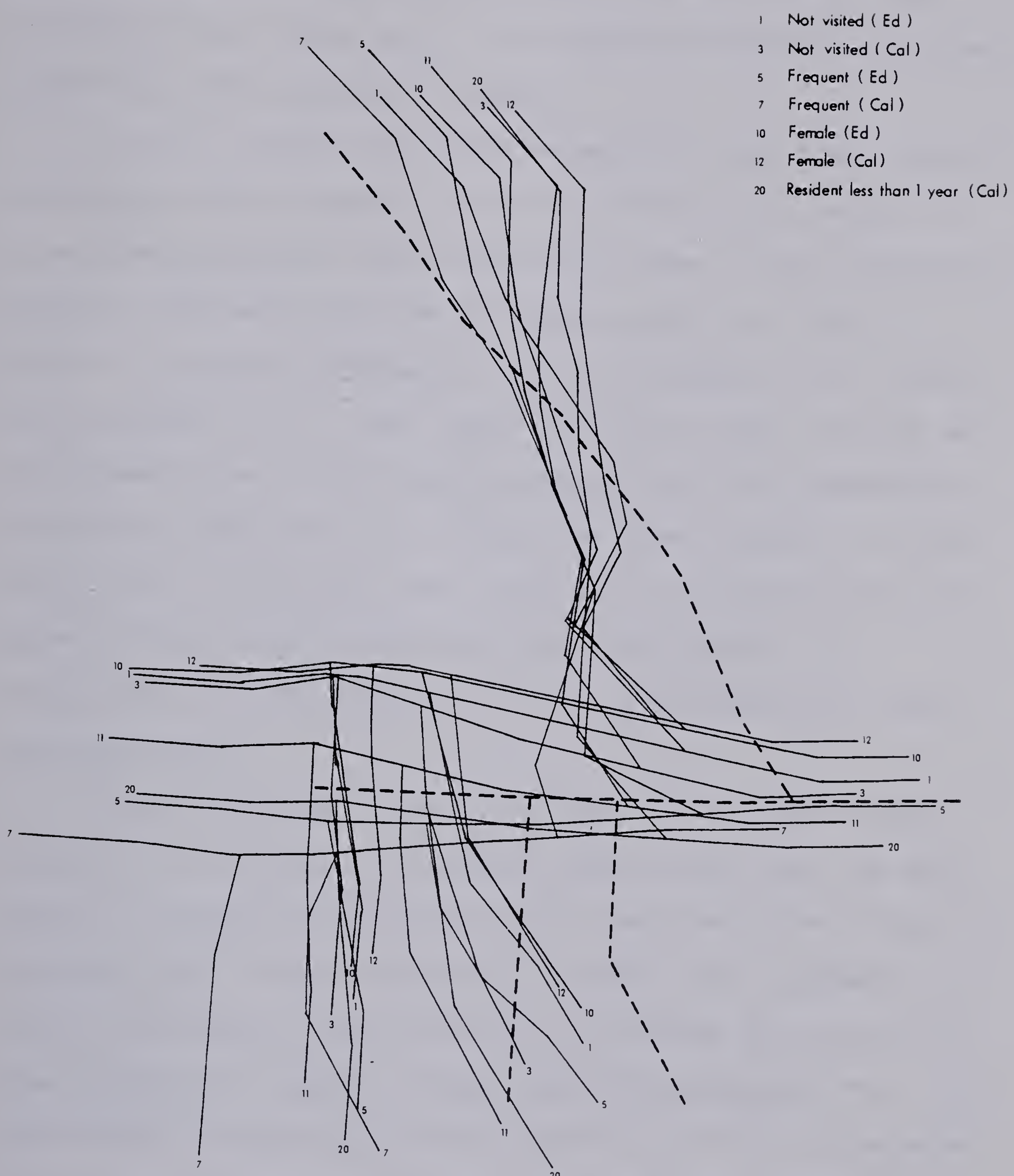

FIG. 19. Boundary Placements for Scattered Variable Groups.

angle is about 60°, but it seems that the Rocky Mountain Ridge and/or the border are aligned in people's minds in a north-south direction rather than at a NW-SE slant. The characteristic 'bite' out of the western Alberta border does appear but only south of Calgary.

The U.S. border and State boundaries have been shifted northwards and westwards, but not with the same amount of consistency between the variables as shown in the Provincial border. The reason for the northwards shift in the U.S. border is because although Fernie and Kimberley are located within 80 Km. of it, the location of both these resorts was perceived to be further north and west of their geographic locations, hence the U.S. border has been 'pulled' in that direction. In addition, the centroids for Big Mountain are generally in a westwards direction (see Figure 14) accounting for the movement of the state borders of Idaho and Washington.

Figure 20 shows a composite map of isolines of equal change in distortion. It can be clearly seen that the major zones of stress are concentrated in two areas: one along the southern part of the Alberta-B.C. border; and adjacent to this, the highest peak of stress is located just north of the Canada-U.S. border. Stress diminishes towards the peripheries, especially in the north, but this is due more to the lack of resorts in that area than the lack of perceptual distortion.

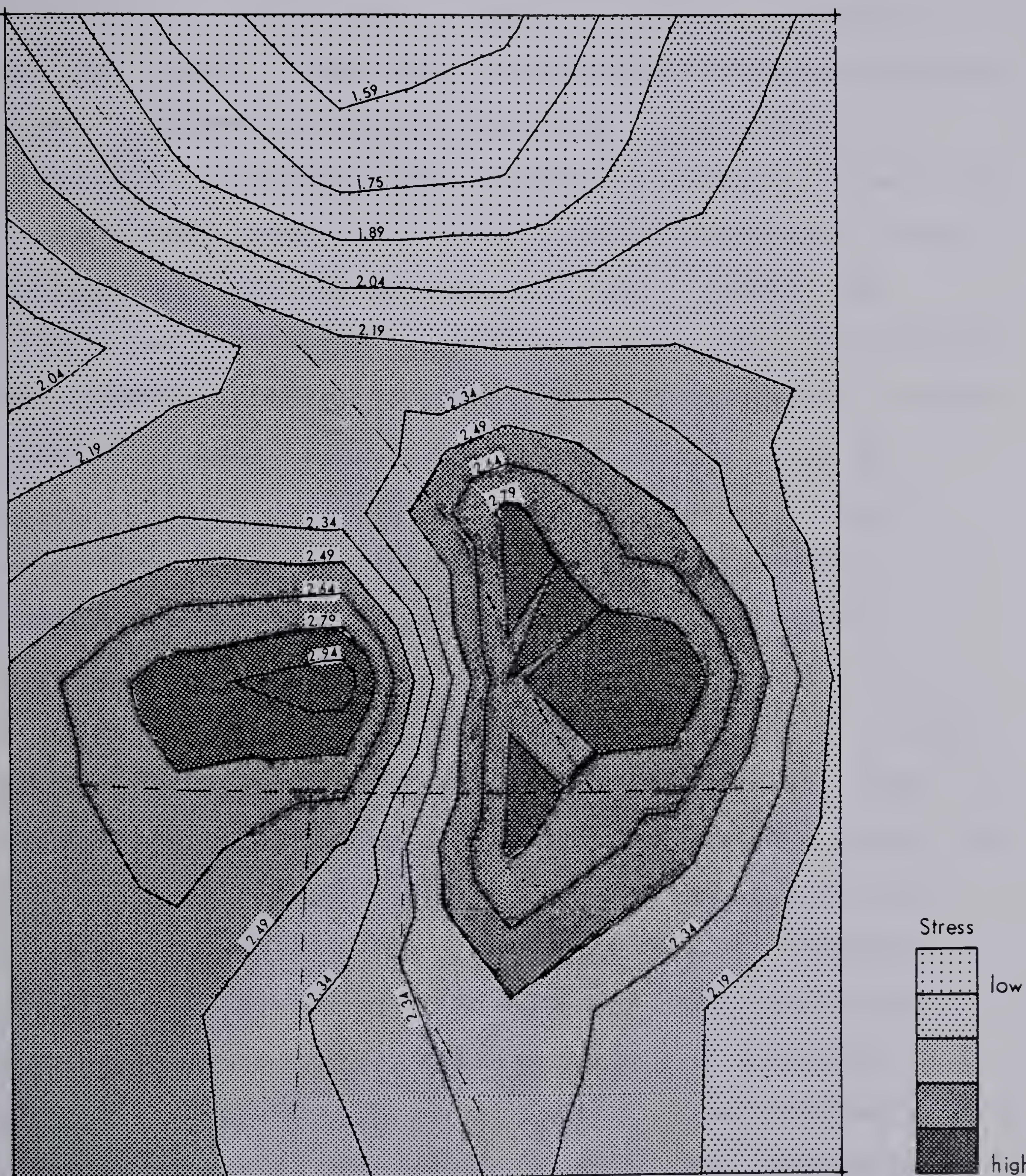

FIG. 20. Isolines of Stress for the Overall Mental Map.

5.1.3 Agreement

The vectors derived from the mean distance and mean direction of each of the variables are shown in Figure 21 for each resort. These vector clusters can be categorized by form: (1) where all the vectors point in one general direction, as in Marmot Basin and Lake Louise; (2) where the vectors trend in opposite directions as in Sunshine Village, Fortress Mountain and Big Mountain; and (3) where the vectors are spread more generally through 180°, as in Fernie and Kimberley. One factor common to all the clusters is that except for Marmot Basin, very few vectors point in an easterly direction, that is towards the Edmonton-Calgary axis. This factor is also displayed by the centroids indicating that there is a general overestimation of distance.

The results from the methodology described in 4.26 are set out in Figure 22. A high degree of clustering in one direction results in low sine and cosine variance values and a value of zero would indicate that all the vectors were concentrated into one line. As the vectors fan outwards, then the variance of both the sine and cosine increases, although not necessarily simultaneously. As the values approach 1, the vectors would be equally spaced through 360° - a case of total disagreement. A comparison of Figures 21 and 22 illustrates this point with Big Mountain the closest to zero and Fernie and Kimberley the most fanned clusters assuming higher variance values. The root mean square error

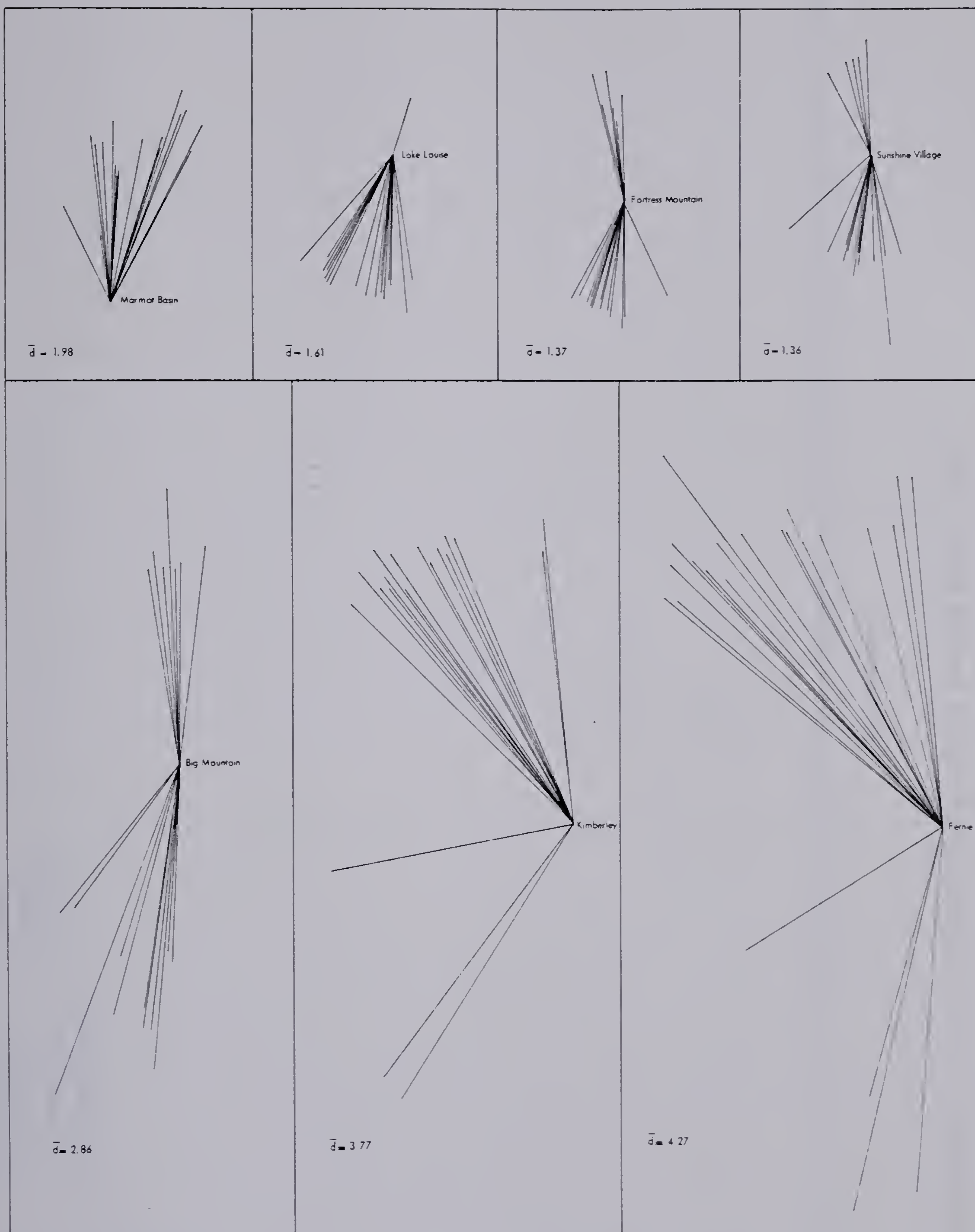

Fig. 21. Vector Clusters Indicating the amount of Agreement between Variables for each resort.

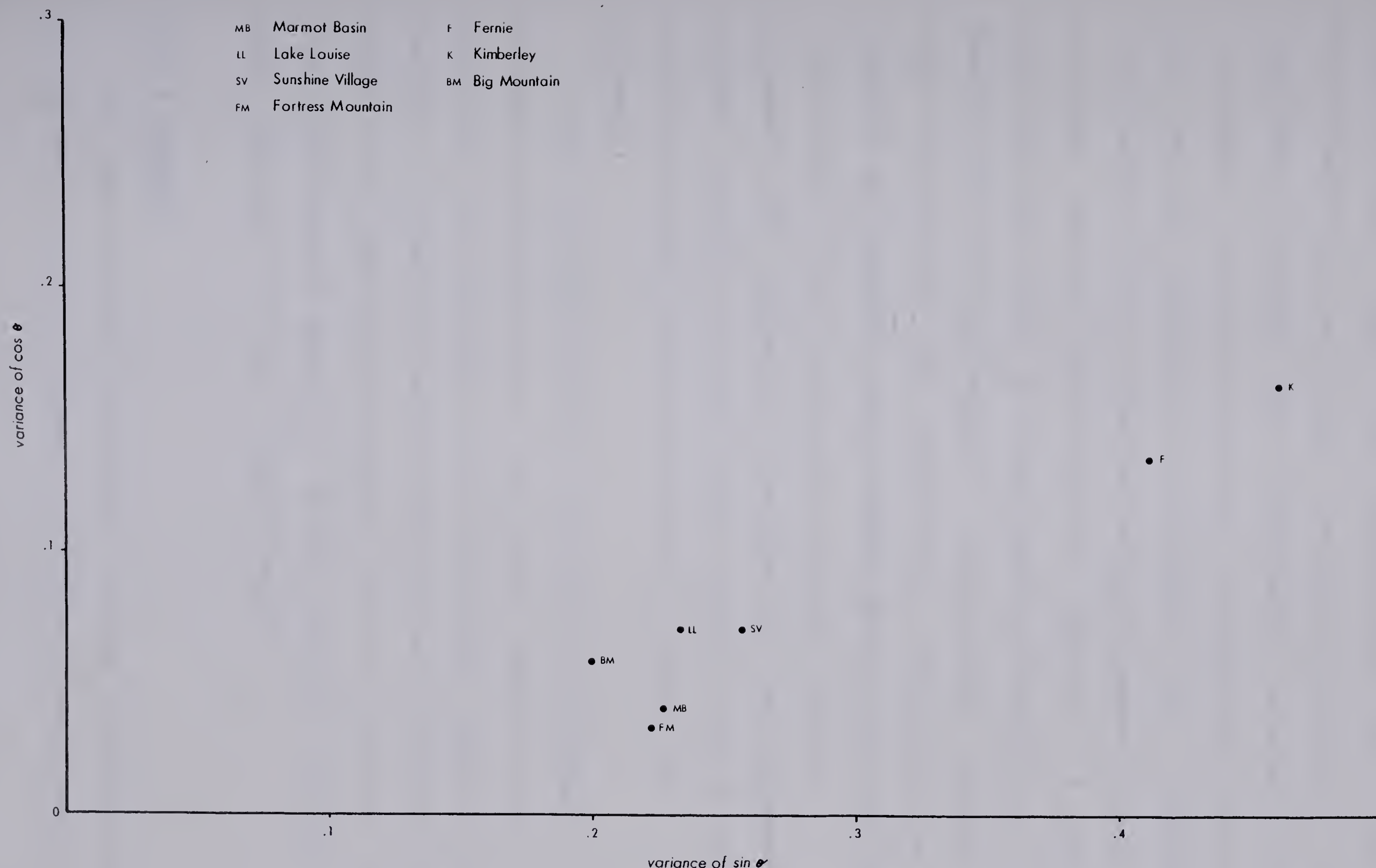

FIG. 22. Plot of the Variance of Sin θ and the Variance of Cos θ from the Vector Clusters.

(RMSE) values in Table 13 are derived from Figure 22 by merely measuring the distance from zero to each point. At this scale, the upper limit is defined by the square root of the length of the axes, resulting in an absolute value of 28.4. Each RMSE therefore is expressed as: 100 - (RMSE/28.4 X 100) which results in the percentage agreement between variables. Applying these results to Figure 21, it appears that even where there is a polarization of vectors as in Big Mountain and Fortress Mountain, the percentage agreement is high (85 and 84 per cent respectively). These polarized clusters are therefore ranked before Marmot Basin and Lake Louise where there is obviously a greater degree of agreement over the general direction, but less agreement between variables. The two British Columbia resorts show considerably more dissention with only 70% and 66% agreement.

Apart from Big Mountain, the amount of agreement concerning the direction of the vectors tends to vary positively with distance, while the average length of the vectors is closely correlated with the mean distance of the resorts from Edmonton and Calgary, with an r_s value of 0.822. Again Big Mountain appears to be the exception, ranking above the nearer British Columbia resorts.

5.1.4 Summary

At the outset of the chapter, a set of hypotheses were set up and tested by a number of different measurements. It

TABLE 13. MEASURES OF AGREEMENT WITHIN THE VECTOR CLUSTERS.

	Variance of Sin θ	Variance of Cos θ	RMSE*	% Agreement	Rank
Big Mountain	.199	.058	4.15	85.4	1
Fortress Mountain	.223	.033	4.48	84.2	2
Marmot Basin	.227	.040	4.60	83.8	3
Lake Louise	.223	.070	4.86	82.9	4
Sunshine Village	.257	.069	5.32	81.3	5
Fernie	.410	.135	8.63	69.6	6
Kimberley	.458	.162	9.72	65.8	7

* RMSE (Root Mean Square Error) found from Figure 22

was found that substantial differences were discernible between the variable groups, but were not so apparent between the sample sets from the two cities. It was also seen that there was considerable agreement within the variable groups concerning the perceived locations of the closer, more familiar resorts. However, the more distant, less familiar resorts caused more dissention within the groups, primarily due to the fact that these resorts were sometimes plotted randomly due to ignorance of their existence, rather than according to the respondents perceptions of the locations. This latter point raises some doubts over the validity of the results concerning Fernie and Kimberley. One of the main aims of the thesis was to find whether between-group differences and within-group similarities in perception existed. It can be concluded that perceptions do differ between different variable groups, and, for familiar areas, there are strong similarities in perception within the variable groups. The modification in the latter statement allows one to suggest that perceptions of a location within a group of people may consolidate with familiarity of that location.

When considering the effect of distance on people's perceptions, the concept of perceptual range was introduced to explain why Edmonton has a similar amount of error as Calgary despite the distance discrepancy. This also explained why the research hypothesis was not supported on many occasions. It was also seen that perceptual error does

not necessarily increase with distance when boundaries are introduced. When there are borders, then the error tends to be concentrated along them, and the hypothetical rate of distance decay is interrupted.

Finally, the amount of agreement concerning the direction and distance of resorts could be evaluated from the vector clusters and it was found with the exception of Marmot Basin, that the westward trend of the vectors, that is, in a direction away from the Edmonton-Calgary axis indicated a consistent overestimation of the distance to the resorts by all the variable groups. This fact may be partly explained by the orientation of the routes to the resorts - the only direct route is to Marmot Basin, the rest involve non-direct or circuitous routes. While the direction of the vectors indicated the amount of agreement, it was found that the average length of the vectors was closely correlated with distance.

However, not all the error has been explained and it is postulated that perhaps the attractiveness of, and preference for a resort may help explain some of the remaining error.

6. ADDITIONAL EXPLANATION OF ERROR: ATTRACTIVENESS AND PREFERENCE DATA

6.1 Attractiveness Data

This chapter will examine two other factors that are important in the formation of perceptions, namely, the attractiveness of the destination and the respondents preference for the location.

6.1.1 Derivation of Groups Concerning Attractive and Unattractive Factors

Question 12 on the questionnaire (see Figure 2b) asked 'What do you consider to be the major attractions of each of the ski areas on Card 1?' The question was open-ended and the respondents could say as much or as little as they liked. The Calgary and Edmonton samples made 762 and 663 comments respectively covering thirty-four different aspects of ski area attractiveness. As a supplement to question 12, question 13 deals with the disliked features of the resorts (see Figure 2b). As in question 12, the Calgary sample made more comments (680) than their counterparts in Edmonton (516), but both totals are lower than those for question 12. Only twenty-nine disliked aspects were mentioned.

For both sets, responses concerning similar aspects were grouped together, giving nine main categories of attractive or unattractive features:

1. Area Layout, which covered comments concerning the

length, number, layout, difficulty or easiness and diversity of the ski runs and the site of the skiing area in general.

2. Snow Conditions, which included such factors as snow amount, the length of the skiing season and general snow quality.

3. People. This group is important to the skier since it covers the crowding factor, the length of the lift lines and how friendly or unfriendly a resort seems.

4. Facilities covers both on- and off-hill facilities such as day-lodges, accomodation, night skiing and apres-ski entertainment.

5. Accessibility. This includes the closeness of a ski area, the ease of access and the general location of the ski area.

6. Physical Environment. Comments concerning the scenery and weather were grouped together. The reasoning behind this pairing lying in the fact that if the weather is poor, then you cannot see the scenery, thus, the one is dependent of the other. Also, these are two prime elements in the physical environment of feeling and seeing. The numerous comments about the scenery (65) seem to indicate that the view plays an important part in the all-round skiing experience; indeed, it was never mentioned as a detracting factor. The importance of weather conditions is readily understood.

7. Cost is mentioned in the context of daily lift-ticket prices and is self-explanatory as a cause of complaint. Occasionally however, it was mentioned as a relative

advantage when one resort has lower prices than the rest.

8. Management covers all the aspects of ski hill management, such as slope grooming, lift efficiency, the amount of development in the area and so on. The low response rate for this group being an advantage or disadvantage to the resorts attractiveness, indicates that management is perhaps taken for granted while other factors are more important to the skiing experience.

9. Different. The fact that a resort is 'different', 'new' or 'good for a change' was sometimes mentioned as an attraction, but never as a detractive factor.

Categorizing the data on both the attractive and unattractive features of a resort into nine groups allows for a more meaningful examination of what is revealed by the responses to question 12 and 13. By taking the response to each attractiveness group for each resort and making it a percentage of the total response for that resort, then the more important attractions are seen (Table 14). The same procedure is followed for the unattractive data, (Table 15).

6.1.2 Discussion

The preceding section dealt with the derivation of the Attractiveness groups from the data. This section will examine the perceived advantages and disadvantages of the resorts and some common trends will be pointed out.

A distinct pattern emerges in Table 16 resulting from the location of the origin cities of Edmonton and Calgary.

TABLE I4. TOTAL RESPONSE TO EACH ATTRACTIVENESS GROUP.

	Edmonton			Calgary		
	Total Response	%	Rank*	Total Response	%	Rank
Area layout	242	36.5	1	260	34.1	1
Snow conditions	136	20.5	2	215	28.2	2
Accessibility	90	13.6	3	58	7.6	4
Physical environment	72	10.9	4	50	6.6	6
Facilities	65	9.8	5	54	7.1	5
People	34	5.1	6	78	10.2	3
Different	11	1.7	7	23	3.0	7
Management	10	1.5	8	12	1.6	8.5
Cost	3	0.4	9	12	1.6	8.5
Total	663	100.0		762	100.0	

* There is a high degree of correlation between cities with $r_s = 0.742$.

TABLE I5. TOTAL RESPONSE TO EACH UNATTRACTIVE GROUP.

	Edmonton			Calgary		
	Total Response	%	Rank*	Total Response	%	Rank
People	126	24.4	1	171	25.1	1
Accessibility	118	22.9	2	157	23.1	2
Area layout	85	16.5	3	98	14.4	3
Snow conditions	65	12.6	4	70	10.3	4
Physical environment	27	5.2	6	61	9.0	5
Cost	48	9.3	5	56	8.2	6
Facilities	24	4.7	7	38	5.6	7
Management	23	4.6	8	29	4.3	8
Different	0	0.0	9	0	0.0	9
Total	116	100.0		680	100.0	

* There is a high degree of correlation between cities with $r_s = 0.977$.

TABLE I6. RESPONSE TOTALS TO QUESTIONS I2 AND I3.

	MB			LL			SV			F			K			BM			FM		
	Q12	total	Q13	Q12	total	Q13	Q12	total	Q13	Q12	total	Q13	Q12	total	Q13	Q12	total	Q13	Q12	total	Q13
Edmonton	141		96	175		103	123		142	47		42	46		34	100		42	31		57
		237			278			265			89			80			142			88	
Calgary	59		53	197		133	157		207	68		53	63		51	112		55	106		128
		112			330			364			121			114			167			234	
Total	200		149	372		236	280		349	115		95	109		85	212		97	137		185
		349			608			629			210			194			309			322	

Except for Edmonton's 'local' resort of Marmot Basin, there is a much greater response for all the ski areas by the Calgary sample. This pattern is due to the fact that Calgary is much closer to all the ski areas (except Marmot Basin) than Edmonton, allowing the student population of Calgary to make 12% more frequent visits to the resorts than their contempories in Edmonton (see Table 2a).

Generally, liked features of a resort are more frequently mentioned than the disliked features, but it appears that two resorts receive more criticism than praise from both city samples: these two being Sunshine Village and Fortress Mountain. They share one detracting feature in common, their area layouts, and while the crowds and accessiblity are Sunshine's main fault, the weather at Fortress Mountain is a common complaint. Sunshine Village has tried to remedy the major problem of accessiblity by replacing the bus service up the hill by a gondola lift which will reduce the line-ups from the parking lot and will increase the up-hill capacity to 1,800 people per hour (private corespondence with Sunshine Village management). However, while the introduction of the gondola may remedy the problem of accessibility, it may exacerbate an existing problem, that of crowding and introduce another detracting feature, that of cost. In the 1979-80 season, Sunshine Village led the lift ticket prices with a daily charge of $15.00. Unfortunately, it is impossible to ameliorate Fortress Mountain's weather.

It appears that some factors are critical to a skier's enjoyment while others are not as important, but which, if present, are regarded as a bonus. Naturally, therefore, people comment more about those factors which, by their presence or absence make or break a successful ski trip rather than those uncritical features. If the Attractiveness and Unattractiveness groups are ranked according to the amount of response that each group generates, we can see which groups are more important to the skier in terms of fulfilling his ski trip expectations. Spearman's Rank Correlation Coefficients (r_s) show that the agreement between cities concerning the attractive and detractive features is high, with r_s values of 0.879 and 0.977 respectively (see Tables 17 and 18).

6.1.3 Attractive Features

In Table 17 the two most important factors requisite for good skiing are obvious - the area layout and the snow conditions. The 1976 Ski Evaluation Study of Alberta also found that 'Quality of Skiing' was rated as the most important factor in choosing a ski location by skiers from Edmonton and Calgary.[1] Where there is a general consensus of opinion as regards the upper and lower rankings, there is some disagreement about the middle ranks of 3 through 6. Calgarians rate the lack of people as the third most important feature for an attractive ski resort while

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[1]Alberta Business and Tourism (1976). Ski Industry Evaluation Study. Travel Alberta, Canada.

TABLE I7. RANKED ATTRACTIVENESS GROUPS ACCORDING TO RESPONSE-GENERATION.

Rank	Edmonton	Calgary
1	Area Layout	Area Layout
2	Snow Conditions	Snow Conditions
3	Accessibility	People
4	Physical Environment	Accessibility
5	Facilities	Facilities
6	People	Physical Environment
7	Different	Different
8	Management	Management
9	Cost	Cost

$r_s = 0.879$ (significant at the .01 level)

TABLE I8. RANKED UNATTRACTIVE GROUPS ACCORDING TO RESPONSE-GENERATION.

Rank	Edmonton	Calgary
1	People	People
2	Accessibility	Accessibility
3	Area Layout	Area Layout
4	Snow Conditions	Snow Conditions
5	Cost	Physical Environment
6	Physical Environment	Cost
7	Facilities	Facilities
8	Management	Management
9	Different	Different

$r_s = 0.977$ (significant at the .01 level)

Edmontonians rank this category sixth. The latter city gives precedence to the groups Accessiblity (third) and Physical Environment (fourth), both of which are readily explicable. With a minimum time-distance of 4 1/2 hours to reach their nearest resort, accessibility or closeness is important to Edmontonians; that they perceive Marmot Basin to be considerably closer than say, Fortress Mountain (when in fact there is only a difference of some 40Kms), can be seen both in the mental maps and in the number of people giving 'closeness' as being Marmot Basins greatest asset. The distance that has to be travelled by Edmontonians is also contributory to the explanation for ranking Physical Environment fourth. Skiers from this city have to expend both more time and money on a ski trip than their southern counterparts. Therefore the possibility of a weekend ski trip being thwarted because of poor weather conditions is an important criterion in the decision-making process of 'where-to-go'. A ski resort with a high percentage of sunny days will hold an obvious advantage over one with dubious weather patterns.

The bottom rankings of Different, Management and Cost belong in that indifferent area mentioned earlier. If the area is 'different' or has 'good management' then these are fringe benefits to the overall attractiveness of a resort.

6.1.4 Unattractive Features

Table 18 shows that the common causes of major

complaint are the crowds at weekends, the difficult access or distance to a resort, the areas' poor layouts and the poor snow conditions. We have seen that the area layout is one of the critical features of a resort and it is for this reason that this category is rated highly in both Tables 17 and 18 (first and third respectively). The rankings are an aggregate for all the responses for all the resorts and where some resorts such as Lake Louise and Marmot Basin are deemed attractive because of their layouts, others, such as Fortress Mountain and Fernie are condemned.

With the rapidly increasing popularity of downhill skiing in the last decade and the restrictions on development imposed by the National Parks, the degree of crowding at some resorts has become a serious problem (witnessed by the fact that it is ranked first by both cities), and so skiers and developers are seeking out new areas which are located within weekend driving distance from the main centres of population of Edmonton and Calgary, such as Panorama and Fairmont, which are both located south of Radium Hot Springs and Fernie and Kimberley to the south.

Both the Edmonton and Calgary respondents rank 'Accessibility' second. With minimum distances of 373 Kms. and 112 Kms. respectively to the two cities' nearest ski resorts of Marmot Basin and Fortress Mountain, it is natural that the distance to be travelled in a detracting factor in ski resort attractiveness. The latter point is especially true in the case of the two British Columbia resorts, whose

nearest large centre of population is Calgary, up to 390 Kms. away. It is unfortunate for the promoters of Fernie and Kimberley that more attractive and closer opportunities to ski exist between the major cities and their resorts, thus the law of intervening opportunities prevails.

What is perhaps surprising is that 'Cost' only ranks fifth and sixth on Table 18 out of nine categories in spite of the fact that ticket prices ranged in 1979-80 from $9.00 to $15.00. It is more easily understood from the Calgary point of view since the majority of people (83%) from this city make day trips and therefore do not incur accommodation costs. However, most skiers from Edmonton make weekend trips and the cost can vary according to the type of accommodation taken and the apres-ski, but for two nights and two days skiing the cost runs from $70.00 upwards. Perhaps the cost is recognized as part of the price you have to pay to ski and is regarded more as a necessary evil rather than a disruptive element in the total satisfaction of a days skiing. However a reduction in the price of day tickets would not be rejected.

Despite the generalities found in the above discussion about what is and what is not desirable in a ski resort, each location enjoys distinct characteristics making it renown for better, such as: the area layout at Lake Louise, the snow conditions at Sunshine Village, the facilities at Big Mountain, and the 'closeness' of Marmot Basin; or for worse, such as the crowds at Sunshine, the snow conditions

at Lake Louise, the facilities at Marmot Basin, the distance to Big Mountain and the wind at Fortress Mountain. It appears that the 'great-all-round' ski resort does not yet exist in the minds of skiers, in this area anyway. Some of the special characteristics of the above resorts are mutually exclusive, such as at Lake Louise where the excellent skiing potential is often unrealized because of poor snow conditions. The reverse situation exists at Sunshine, some 40 Kms. down the road, where they have good snow conditions but the area layout is a drawback and the long line-ups limit the amount of skiing possible in a day.

It would seem from the above discussion that the formulation of a Perceived Attractiveness Index (P.A.I.) would help to give an overall picture of the desirability of the seven ski resorts. This index can then be compared with an Actual Attractiveness Index (A.A.I.) to see if the P.A.I. conforms with the actual facts (or what the resorts project for themselves). In addition, it would be instructive to compare the P.A.I. with the preference rankings to see if the two conform.

6.1.5 The Perceived Attractiveness Index

The Perceived Attractiveness Index (P.A.I.) is best constructed by taking one resort at a time and summing all the responses for all the categories of the unattractive factors and subtracting the total from the summation of the responses for the attractiveness factors, giving a positive

or negative value, such that:

$$P.A.I. = \sum_{i=1}^{n} RA_i - \sum_{i=1}^{n} RD_i \qquad (1)$$

where:

- n is equal to the nine categories;
- RA_i is the response to each of the attractiveness categories;
- RD_i is the response to each of the unattractive categories.

Higher positive scores mean that the resort has more attractive than unattractive features. A score of zero would indicate that the resort has an equal number of perceived advantages and disadvantages. Negative values show that the resort is perceived as having more disliked features than attractions.

The results from (1) are shown in Table 19. The resorts are ranked according to their perceived relative attractiveness. There is obviously considerable agreement between the two cities concerning the perceived attractiveness of the resorts (r_s = 0.822), especialy for the most liked and disliked resorts. Lake Louise and Big Mountain are seen in a very favourable light, but Fortress Mountain and Sunshine Village are criticized. The middle rankings of Marmot Basin, Kimberley and Fernie are reversed between the cities. An interesting factor to note in Table 19 is that the Edmonton sample perceives its 'local' resort of Marmot Basin to be considerably more attractive than the

TABLE 19. RESORTS RANKED ACCORDING TO PERCEIVED ATTRACTIVENESS INDEX.

Rank	Edmonton		Calgary		Total Scores	
1	Lake Louise	75	Lake Louise	64	Lake Louise	139
2	Big Mountain	58	Big Mountain	57	Big Mountain	115
3	Marmot Basin	45	Fernie	15	Marmot Basin	51
4	Kimberley	12	Kimberley	12	Kimberley	24
5	Fernie	5	Marmot Basin	6	Fernie	20
6	Sunshine Village	-19	Fortress Mountain	-22	Fortress Mountain	-48
7	Fortress Mountain	-26	Sunshine Village	-50	Sunshine Village	-69

r_s = 0.822 (significant at 0.01)

TABLE 20. AGREEMENT BETWEEN RESPONDENTS CONCERNING THE ATTRACTIVENESS OR UNATTRACTIVENESS OF THE RESORTS*.

Edmonton		Calgary	
Fernie	0.59	Marmot Basin	0.61
Big Mountain	0.56	Big Mountain	0.58
Sunshine Village	0.43	Kimberley	0.54
Kimberley	0.39	Sunshine Village	0.49
Fortress Mountain	0.34	Fernie	0.40
Lake Louise	0.29	Fortress Mountain	0.38
Marmot Basin	0.17	Lake Louise	0.32

* A score of 1.00 would indicate total agreement and zero would show total disagreement.

corresponding third ranked resort in the Calgary sample. The low values for the two British Columbia resorts may be attributed to the fact that they are the least well known of all the resorts, with 16 and 17 per cent of the sample never having heard of Fernie and Kimberley respectively.

In order to see how much agreement is present between the respondents concerning the liked and disliked aspects of the resorts, we must compare the attractive and unattractive response totals for each category, for each resort at a time by:

$$\sum_{i=1}^{n} \left(\frac{A_{1i} - D_{1i}}{A_{1i} + D_{1i}} \right)^2 = \text{agreement} \qquad (2)$$

where A_{1i} is the response for each attractiveness group and D_{1i} is the response to the corresponding unattractive group. If the response is high for example in A and low in D, then it may be said that there is a high degree of agreement concerning that particular category and the agreement factor will approach 1. If the response totals in A and D are similar, then there is dissention between the respondents and the agreement factor will approach zero.

The results obtained from (2) are shown in Table 20. These show the amount of agreement concerning the attractiveness or unattractiveness of each resort. The Edmonton sample agree on the attractions of Fernie and Big Mountain and the detractive features of Sunshine Village. They disagree most strongly about their most familiar resort - Marmot Basin. On the contrary, Calgary agrees most over

Marmot Basin, but disagrees on the attractiveness of one of their most popular resorts - Lake Louise. Like Edmonton, they agree on the attractiveness of Big Mountain.

6.1.6 Actual Attractiveness Index (A.A.I.)

Facts about the resorts have to be obtained from a number of different sources in order to get a complete picture since no two sources give the same set of facts.[2] Which factors to include was in part determined by those features that received a high response in Questions 12 and 13, such as 'size of area', 'distance', 'number of runs', 'length of season'. Other oft-mentioned features had to be excluded because of their non-quantifiable nature such as 'nice scenery', and 'crowding' - the ski resorts do not advertise the length of lift-lines at weekends. The final list of resort features is shown in Table 21 with the respective figures pertaining to each resort. The method of categorizing the figures to obtain A.A.I. values was constructed so as to try and ensure that for each feature, all categories would be represented (see Appendix 2), however, this was not always possible. The A.A.I. is derived by summing all the points for each resort. The highest possible total that can be obtained is 55 and the minimum is

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[2] The sources included the individual resort brochures; The 1976 Ski Evaluation Study (see footnote 80); 1979-80 White Snow - a Skiers Guide to North American Resorts; private correspondence with Sunshine Village, Lake Louise and Fortress Mountain managements; and with Alberta Business Development and Tourism Office (Parks and Recreation Branch).

TABLE 21. ACTUAL RESORT STATISTICS AND AAI SCORES DERIVED FROM APPENDIX 2.

Resort Statistics	Marmot Basin		Lake Louise		Sunshine Village		Fernie		Kimberley		Big Mountain		Fortress Mountain	
Vertical Drop (m)	701	2	991	3	563	1	640	2	701	2	649	2	335	1
Number of Lifts	5	2	9	3	11	3	5	2	5	2	6	2	6	2
Total no. of runs	25	2	34	3	28	2	13	1	29	2	27	2	30	2
Total no. of beginner	9	2	8	2	10	3	5	2	7	2	7	2	4	1
Total no. of intermediate	9	1	10	2	9	1	6	1	19	3	15	2	14	2
Total no. of advanced	7	2	16	3	9	2	2	1	3	1	5	2	12	3
Longest run (km)	5.6	2	8	3	3.6	1	5	2	6.4	2	4	1	2	1
Ski school	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
Ski shop/rental	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
Day Lodges (no.)	2	2	3	3	1	1	1	1	1	1	5	5	1	1
Lift cost (1979-80) ($)	11.50	2	14.00	1	15.00	1	9.00	3	10.00	2	10.50	2	10.00	2
Uphill capacity/hr.	4600	1	7600	2	12,150	3	3200	1	3150	1	3718	1	5000	2
Snow amount (cm)	635	2	470	1	1016	3	635	2	274	1	762	2	508	2
Length of season (months)	early Dec- end April (5)	2	Dec- end April (5)	2	early Nov- late May (7)	3	late Nov- end April (5½)	2	Dec- mid March (3½)	1	end Nov- mid April (5)	2	mid Nov- beg May (5½)	2
Distance to Edmonton (km)	373	2	465	2	438	2	622	1	688	1	859	1	412	2
Distance to Calgary (km)	412	2	182	3	148	3	322	2	388	2	617	1	112	4
Night skiing	No	0	No	0	No	0	No	0	Yes	1	Yes	1	No	0
Elevation upper (m)	2433	2	2637	3	2722	3	1707	1	1982	1	2134	2	2378	2
Elevation lower (m)	1732	2	1540	2	2159	3	1067	1	1280	1	1448	1	2043	3
Total		32		40		37		27		28		33		34

15. Therefore, assuming that each resort must have a basic 15 points, the remainder may be regarded as bonus points out of a possible 40. The resorts can now be ranked according to the A.A.I. as in Table 22.

6.1.7 Comparison of the P.A.I. and A.A.I.

To see if the A.A.I. and P.A.I. correspond, the ranked sets may be correlated using Spearmans Rho Correlation coefficient. Table 22 shows that there is no correlation between the P.A.I. and A.A.I. for both cities. The only agreement between the sets concerns Lake Louise which is ranked first.

When the rankings of the resorts are compared, it can be seen which resorts are perceived to be more attractive than they really are and which possess a poorer image in the minds of skiers. For both cities, Big Mountain, Fernie and Kimberley are perceived as being more attractive, and Sunshine and Fortress Mountain are perceived as being less attractive. The reason for the latter findings may be because the factors receiving the most criticism for these two resorts are of a non-quantifiable nature namely, the crowds at Sunshine and the weather at Fortress. Therefore, while the snow statistics and the dimensions of the ski area may be satisfactory in this case, it is those other factors that are important in shaping skiers' perceptions. The reason why Big Mountain, Fernie and Kimberley are upgraded in people's opinions may be because they are less-known or

TABLE 22. COMPARISON OF THE AAI AND PAI.

Rank	AAl	PAl (Edmonton)	PAl (Calgary)
1	Lake Louise	Lake Louise	Lake Louise
2	Sunshine Village	Big Mountain	Big Mountain
3	Fortress Mountain	Marmot Basin	Fernie
4	Big Mountain	Kimberley	Kimberley
5	Marmot Basin	Fernie	Marmot Basin
6	Kimberley	Sunshine Village	Fortress Mountain
7	Fernie	Fortress Mountain	Sunshine Village

Correlation AAl and PAl (E) $r_s = 0.143$

Correlation AAl and PAl (C) $r_s = -0.035$

that skiers who visit these resorts go for a longer period than a weekend thereby avoiding the weekend crowds.

It appears therefore that there is little correlation between the actual attractiveness of a resort and the perceived attractiveness. One reason for the almost total lack of agreement between the ranked sets may lie in the fact that the A.A.I. does not include those non-quantifiable factors which we have seen may be the most critical to the resort's image. It would be instructive therefore in future research to set up a more controlled test on perceived attractiveness utilizing a list of those features that are used in the A.A.I. By doing this the relationship between perceived and actual attractiveness may be better understood. However, the advantage of the method used in the present study was that the use of open-ended questions avoided directing people's comments and so respondents mentioned only those factors that first came to mind, which were probably the most critical to their perception of the resort. Despite the flaws in the method, it is clear that there is no relationship between the A.A.I. and the P.A.I., suggesting that the P.A.I. is a more useful measure for judging the attractiveness of a resort than the actual resort statistics themselves.

If the perceptions of the attractiveness of a resort are more useful than the actual facts of a resort, it is now time to see if any more of the error in the mental maps may be explained, remembering that the other variables could not

explain all the error present. The mean of the x,y coordinates of all those people who named attractions for each resort is found in the same way as for the other variables (see 4.23). The centroid may also be found for those who named detractive features for each resort. These centroids may be plotted (as in Figure 23) in relation to the geographic resort location and to the centroids accounting for the minimum and maximum error (as shown in Figures 11 and 12). It is clear that in most cases, the centroids for people who perceive the resorts as being attractive are less erroneous than the centroids of those who find then unattractive, but these data do not, on any occasion, help to explain any more of the error present in the mental maps; the centroids are not located closer to the resort than the minimum variable placement.

6.2 Preference Data

6.2.1 Demand Levels and Threshold

Despite finding overall factors that are critical to the skiers skiing experience, there are different demand levels within those factors depending on the skier group. Novices will be more attracted to resorts boasting wide, open, flatter pistes than to those catering more for the advanced and good intermediate skiers who will demand steeper, longer and more challenging runs. Snow conditions are not as important to the beginner than perhaps the weather - it is a chilly business to learn to ski in cold

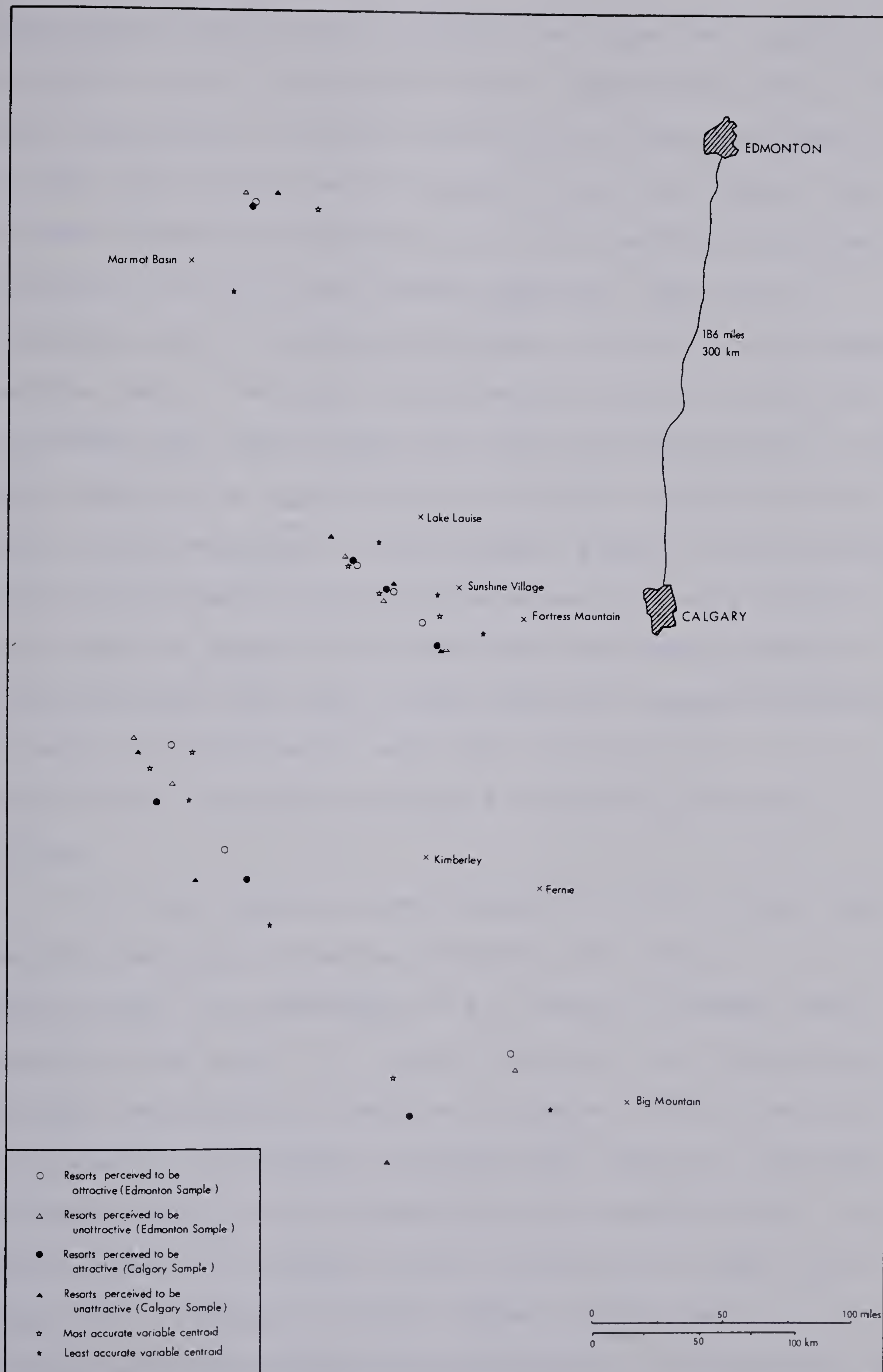

FIG. 23. Location of the Centroids derived from the Attractiveness Data.

conditions. The fact that a resort has a good ski rental system is crucial to some and totally ignored by others. The more 'recreational' skiers are only satisfied when there is not one, but several well-stocked bars on the slopes. The personal demands are endless and it is therefore not often possible to fulfill every skiers personal ideal and a compromise has to be made on the part of both the developers and the users. The skier is fortunate in that he can pick and choose the resort that best meets his expectations - an expert may not be satisfied with Sunshine's easier terrain and a novice may quail at the steeper slopes of Lake Louise. Fernie and Kimberley promote themselves as family resorts which may not appeal to the more ebullient party-seekers. Therefore each skier has his own personal evaluation system of what is attractive or what best fulfills his expectations. Here the problem of intervening distance arises.

If all ski areas are equidistant from the origin then the only decision to be made would be the one of where-to-go. If a knowledge of all areas is assumed, then generally the skier will choose the resort most attractive to him. The decision is much more complex when differential distances are introduced; assuming that there is a certain minimum distance to be travelled to the nearest resort, how much further will skiers travel to find a ski resort that meets their demands? In other words, is there an attractiveness/perceived distance threshold beyond which the

attractiveness of a resort does not warrant the extra travel involved? This threshold will vary according to different skiing abilities and different demands. It will also vary with the 'pull' effect of the resort and the 'push' effect of nearer but less attractive resorts. One way to examine the pull-push effect is to look at people's preferences, (which were revealed through Question 5 on the Questionnaire) to see if people actually go to their most preferred resort or whether their preferred resort is beyond their threshold. In addition, it would be instructive to compare the revealed and stated preference rankings. The manner in which the resorts have been ranked by the P.A.I. may be called 'revealed' preferences since they have not been stated directly, but rather the skiers have revealed which resorts they have a preference for by evaluating each resort's attractions. The preference rankings obtained from question 5 may be called 'stated' preferences because these were acquired through a direct question. First however the methods by which the preference data were analyzed should be discussed.

6.2.2 Methods of Analysis

The method used to find the mean preference rank of each resort may be called the 'frequency of response' method. Taking one resort at a time, the number of times that resort was given rank 1, rank 2 and so on were summed and the rank with the greatest response was taken as being

indicative of the overall preference ranking of that resort with regard to the other six ski areas. The results obtained from this method are set out in Table 23. The respondents show considerable agreement over the most preferred and least preferred resorts of Big Mountain and Fortress Mountain which have high values for ranks 1 and 7 respectively. There is less agreement over the middle rankings of such resorts as Marmot Basin, Sunshine Village and Kimberley indicating that where one resort may be one skier's favourite, it is another skier's least preferred area. Gould found that ranking the 'middle' of the sample posed problems for his respondents, either because the places were unknown or the subject was indifferent to them.[3] Although a few of the respondents had not heard of some of the resorts, the number to be ranked was so small that ranking them did not cause too much difficulty, even so, there was still a considerable amount of disagreement.

The ranks of the two cities were compared to see if the preferences of skiers vary with their place of origin. Again it appears that there is a consensus of opinion for the extremes: Lake Louise (r_s = .93) and Fortress Mountain (r_s = .97). The greatest amount of disagreement between the cities concerns the ranking of Fernie (r_s = .32). The remainder have moderate positive correlation values.

There are two ways of examining the amount of agreement

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[3] P.R. Gould, (1975). People in Information Space: The Mental Maps and Information Surfaces of Sweden. Lund Studies in Geography, 42B.

TABLE 23. RESPONSE TO EACH PREFERENCE RANKING FOR EACH RESORT.

Ranks	Marmot Basin	Lake Louise	Sunshine Village	Fernie	Kimberley	Big Mountain	Fortress Mountain
	Calgary						
	Resorts						
1	2	<u>38</u>	12	8	7	<u>52</u>	1
2	12	20	20	17	12	33	6
3	22	17	20	<u>31</u>	11	10	9
4	<u>27</u>	19	14	23	17	7	13
5	22	14	<u>23</u>	18	25	6	12
6	22	8	<u>23</u>	19	<u>28</u>	5	15
7	13	4	8	4	20	7	<u>64</u>
	Edmonton						
1	12	29	9	5	5	<u>59</u>	1
2	19	<u>42</u>	16	16	12	13	2
3	23	19	<u>26</u>	14	20	13	5
4	23	18	22	21	20	7	9
5	<u>24</u>	4	16	19	<u>34</u>	10	13
6	14	6	18	<u>25</u>	21	12	24
7	5	2	13	20	8	6	<u>66</u>

<u>N</u> the rank which receives the greatest response for each resort.

present within and between the response groups at the individual level: one is to use Kendall's Coefficient of Concordance; the other is to use the Gibbs-Martin Index of Diversification.[4]

6.2.3 Kendall's Coefficient of Concordance: W

Where Spearman's rho expresses the degree of association between two variables measured in, or transformed to ranks, W measures the general agreement among a set of m rankings of n objects. The matrix is set up in such a way that there are n columns (ski areas) and m rows (subjects). The ranks in each column are then summed, obtaining the numbers: 533, 351, 477, 459, 565, 285, 690. These numbers must sum to 3360 from $mn(n+1)/2$, and reflect the degree of resemblance among the rankings. Let S be the sum of the squares of the observed deviations from the mean. If the concordance is perfect, the sums are m, 2m, ..., nm, but not necessarily in that order, and the sum of s is $m (n -n)/12$ and s is at a maximum. If everyone disagreed, the sums would be equal to the mean: $m(n+1)/2 = 480$. From this, W can be calculated:

$$W = \frac{12S}{m^2(n^3 - n)} \qquad \frac{(\text{observed deviation from } S)}{(\text{maximum deviation from } S)} \tag{3}$$

W may vary from 0 (no concordance) to 1 (total concordance) and the resultant value is called the coefficient of

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[4] J. Gibbs, and Martin, (1962). "Urbanisation, Technology and the Division of Labour: International Patterns." American Sociological Review, 27.

concordance.

For Edmonton, S = 123370 and W = 0.3059; for Calgary, S = 109250 and W = 0.2709. These results show that the level of concordance is weak and that there is little ressemblance among the rankings. The coefficient for Edmonton is slightly higher than that for Calgary indicating slightly more agreement between the respondents.

6.2.4 The Gibbs-Martin Diversification Index

The Gibbs-Martin Index also describes the amount of agreement (or diversification) between a set of respondents and can be written:

$$G.M.I. = 1 - \Sigma\Sigma X_i^2 / (\Sigma\Sigma X_i)^2 \qquad (4)$$

where x is the cumulated frequency response for each resort ranking. If all subjects disagree, the frequency values are evenly distributed and the index approaches 1.[5] For the Edmonton and Calgary examples, the computed indices were almost identical with values of 0.9766 and 0.9765 respectively. Like the values obtained from Kendall's Coefficient of Concordance, these values indicate that there is only weak agreement within the subject groups, but since the two values are very similar, it can be concluded that the two subject groups concur in their disagreement.

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[5] J-C. Muller, (1976). "Objective and Subjective Comparison in Choropleth Mapping." The Cartographic Journal, December 1976, 156-166.

6.2.5 Discussion

From the above indices, it can be seen that the skiers from Edmonton and Calgary agree in their disagreement concerning the ordering of the seven ski resorts based on their preferences (r_s = .75; W = 0.31 and 0.27; G.M.I. = 0.976). However, the degree of concordance within each set of respondents is low, tending towards 0 in the Kendall Coefficient of Concordance method and towards 1 in the Gibbs-Martin Index. The reason for these low agreement values lies in the middle-order rankings. We saw earlier that there was a high degree of concordance between the subjects concerning the most and least preferred resorts (Big Mountain, Lake Louise and Fortress Mountain), but there is considerable disagreement over the middle preferences.

There appears to be a contradiction between the results obtained from the different methods. The Spearman's Rank Correlation Coefficient showed a high degree of agreement for the upper and lower rankings. On the other hand, this agreement does not appear in either Kendall's Coefficient of Concordance or in the Gibbs-Martin Diversification Index. The reason for this discrepancy may lie in the fact that the Spearman's Rank Correlation Coefficient was based on the aggregated results relative to one another. Kendall's W and the Gibbs-Martin Index on the other hand, took the data at an individual level, that is, a matrix of 840 rankings, and hence personal differences in the rankings are more apparent. It is for this reason that the agreement between

the respondents concerning the upper and lower rankings as found by Spearman's Coefficient is obscured and is not found in either the results from Kendall's W or the Gibbs-Martin Index. The methods therefore may be regarded as being complementary to each other.

6.2.6 Comparison of Revealed and Stated Preferences

By requesting the ranked preferences of respondents, information has been obtained about skiers' preferences on a straight-forward judgement scale, but are people's answers consistent with what they really believe, or do they answer what they think they are expected to say? For example, Green *et al*., in a study of preferences for different models of cars, found relatively low agreement between people's stated preference rankings and the cars they revealed a preference for in their purchases.[6] Ewing and Kulka contrasted revealed and stated preferences for ski areas in Vermont and found that there was a greater polarization of choices in real behaviour than in introspective responses about preference.[7]

To see whether there is such a difference in the present study, actual behaviour, revealed preferences and stated preferences, and the P.A.I. rankings may be compared and also the relationship between the usually visited area

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[6] P.E. Green, *et al* (1969). "Self-Concept and Brand Preference: An Empirical Application of Multidimensional Scaling." *Journal of the Market Research Society.* 11, 340-360.

[7] G.O. Ewing, and T. Kulka, (1979). "Revealed and Stated Preference Analysis of Ski Resort Attractiveness." *Leisure Sciences*, 2, Nos. (3,4), 249-275.

and preferences may be examined. Table 24 shows the P.A.I. and preference ranked sets for both cities. Although the sets are quite closely correlated with r_s values of 0.741 for Edmonton and 0.813 for Calgary (both significant at 0.05), there are variations between the rankings indicating that what a person reveals as being a preference and what they actually state is sometimes anomalous (see Table 24). In the Edmonton rankings, Big Mountain and Sunshine Village were two resorts which were stated as high preferences but were revealed as being lower down the scale, while Lake Louise, Marmot Basin and Fernie were promoted from their assigned stated rankings to higher revealed preference ranks. Kimberley and Fortress Mountain remain with the same ranks (4 and 7 respectively) on both scales. In the Calgary set, the top three rankings remain the same while Kimberley and Fortress are in this case promoted and Sunshine Village and Marmot Basin have lower revealed preference rankings than stated preferences.

When we look at the preference ranks that people assign to the resort they usually visit, we can see (Table 25) that three resorts in the Edmonton sample were ranked first by 38%, 100% and 60% of those people who usually go to those resorts. An indication that a time-distance-cost threshold exists is shown by the fact that out of all those who rank Big Mountain first, only 9% make this resort their usual destination. Three resorts in the Calgary sample are also ranked first by the people who usually go there, but in this

TABLE 24. COMPARISON OF THE REVEALED (PAI) AND STATED PREFERENCE RANKINGS.

Rank	Revealed Preference PA1 (Edmonton)	Stated Preference (Edmonton)	Revealed Preference PA1 (Calgary)	Stated Preference (Calgary)
1	Lake Louise	Big Mountain	Lake Louise	Lake Louise
2	Big Mountain	Lake Louise	Big Mountain	Big Mountain
3	Marmot Basin	Sunshine Village	Fernie	Fernie
4	Kimberley	Marmot Basin	Kimberley	Marmot Basin
5	Fernie	Kimberley	Marmot Basin	Sunshine Village
6	Sunshine Village	Fernie	Fortress Mountain	Kimberley
7	Fortress Mountain	Fortress Mountain	Sunshine Village	Fortress Mountain

Correlation between revealed and stated preference for Edmonton $r_s = 0.741$.

Correlation between revealed and stated preference for Calgary $r_s = 0.813$.

TABLE 25. A COMPARISON OF OVERT BEHAVIOUR AND PREFERENCES*.

	Edmonton				Calgary			
	Usually go Rank assigned	by %	Do not usually go Rank assigned	by %	Usually go Rank assigned	by %	Do not usually go Rank assigned	by %
Marmot Basin	2	24	4	25	0	0	4	23
Lake Louise	1	38	2	36	1	49	1	20
Sunshine Village	2	30	3 & 4	41	2 & 3	28	6	28
Fernie	3	67	6	21	1	100	3	26
Kimberley	1	100	5	29	1	100	6	24
Big Mountain	1	60	1	49	0	0	1 & 2	71
Fortress Mountain	0	0	7	56	3	28	7	61

* In each case the rank given by the highest number of 'usually go' or 'do not usually go' skiers is shown.

case, the resorts are Lake Louise, Fernie and Kimberley (see Table 25). Again Big Mountain is ranked first by a substantial number (71%) of skiers who do not usually go there, while Lake Louise is also ranked first by 20% of those who do not make Lake Louise their usual destination.

While it seems that for the closer resorts, people tend to go to the one that they most prefer, a distance threshold does exist in the case of Big Mountain and so many skiers have to compromise by going to their second or third most preferred resort. It is also clear that there are some discrepancies between revealed and stated preferences mainly occurring round the middle rankings since skiers appear to have formed strong opinions about their most and least preferred resorts and the most attractive and unattractive features belonging to those resorts.

As with the attractiveness data, the centroids for preference groups can be plotted (Figure 24) to see if any more of the unexplained error can be explained and also to see if the group rating a resort high in its preferences has a less erroneous image than one which rates that resort poorly. The seven preference ranks were grouped into three: high preference (ranks 1 and 2); medium preference (ranks 3, 4 and 5); and low preference (ranks 6 and 7).

In Figure 24, it can be seen that there are only three occasions when a preference centroid is located closer to the resort than the minimum centroid placement derived from the variables. But these centroids are so close and they

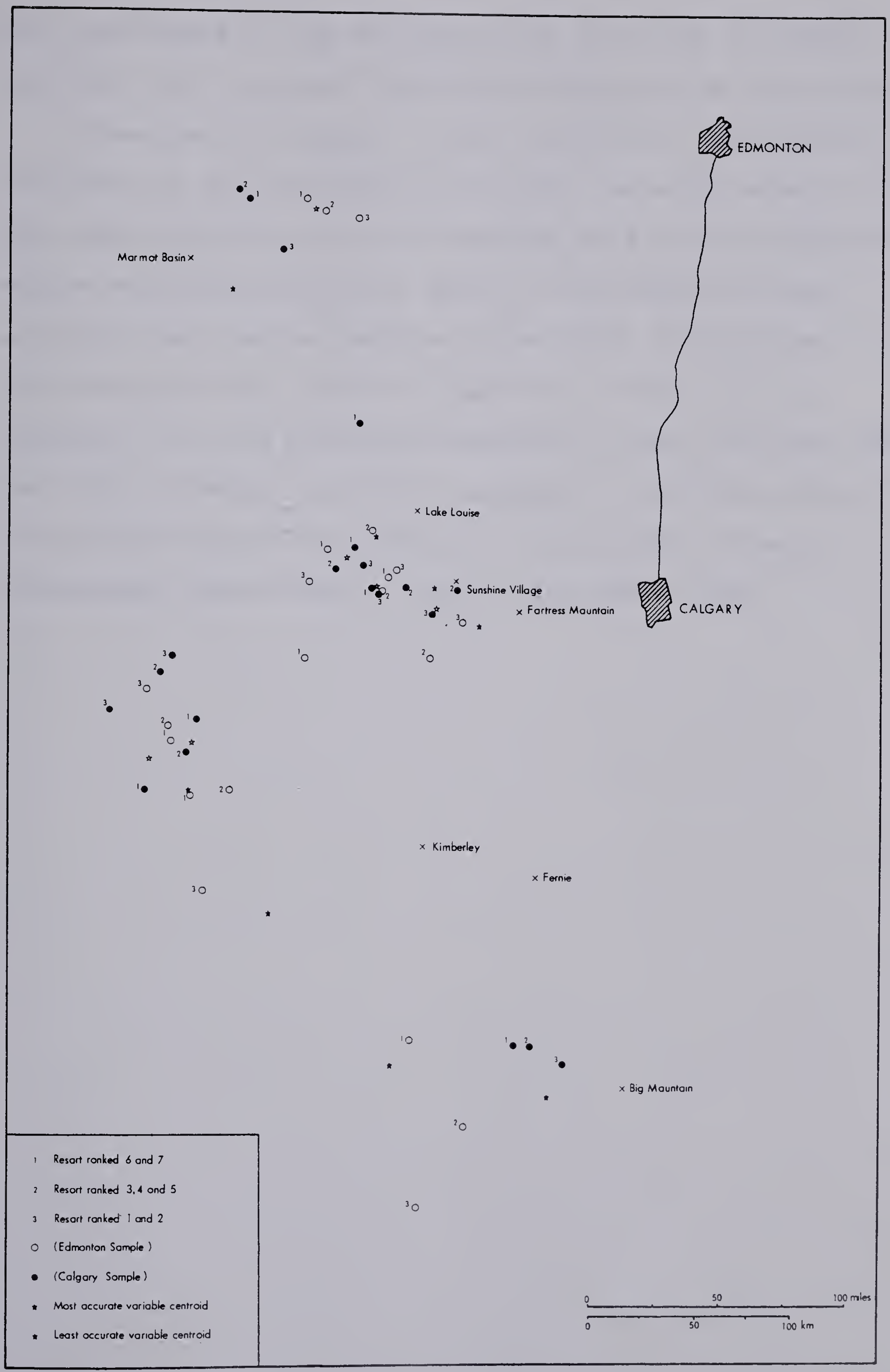

FIG. 24. Location of the Centroids derived from the Preference Data.

only contribute to the explanation of the error on three occasions that no significant conclusions can be forwarded.

There does not appear to be a pattern in the relative locations of the preference centroids. One might expect that the high preference centroid would be more accurate than the medium preference centroid, which in turn would be more accurate than the low preference centroid. This pattern is only revealed four times in Figure 24. In fact, on six occasions, the low preference centroid is more accurate than the high preference centroid, so again it would be unsound to draw conclusions regarding the relationship between preferences and the error found in the mental maps.

7. STRUCTURAL MODEL

The previous chapters discussed the error in the mental maps of skiers in terms of a number of variables. It was seen that some variables contribute more to the error in mental maps than others, and although most of the error could be explained, it was found that in all cases, some error still remained. In order to synthesize the findings and to understand the relationships between all the variables and the error, a model is required. The model presented here is the result of a study of the error in cognitive maps, not of recreation, but the recreational application necessitates some explanation of the development of the use of the concept perception in recreational trip modelling.

The conventional approach to recreation modelling emphasized the activity as being the primary recreation experience. However, some researchers have realised the limitations of such an approach and have set about incorporating behavioural and perceptual constructs into their models.

The chief limitation of the activity approach outlined by Driver and Tocher is that it frequently assumes that a supply of recreational facilities defines the recreationists' preferences for those facilities. They question the fact that latent preferences are not being met

and that the emphasis has been on supply rather than demand.[1] To overcome these limitations they propose a 3-stage model. The first or antecedant stage incorporates such motivational factors as environmental stimuli, prior learning, physiological drives, spatial awareness, social status and values.[2] It may be said that all these factors influence the structuring of an individual's awareness space. The second or intervening stage includes those conditions encountered in pursuit of the final goal, which contribute to the learning process. The final stage consists of the comparison of the anticipation of the attractiveness of a site and the value or utility of the site once it has been reached. A feedback loop then connects the final stage with the initial stage and the process therefore may be regarded as a continuum within which cognitive structuring is considered only during the antecedant stage.

The limitation recognised by Clawson and Knetsch is that too often the definition of a recreational experience has been restricted to the actual on-site activity.[3] They propose instead that the recreational experience is the sum of five distinct phases: anticipation; travel to the site;

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[1]B.L. Driver and S.R Tocher, (1974). "Toward a Behavioural Interpretation of Recreational Engagements with Implications for Planning", from D.W. Fischer, J.E. Lewis and G.B. Priddle, (eds.) Land and Leisure: Concepts and Methods in Outdoor Recreation. Maaroufa Press, Inc., Chicago.

[2]B.L. Driver, (1976). Toward a Better Understanding of the Social Benefits of Outdoor Recreation Participation. U.S.D.A. Forest Service General Technical Report SE9, 163-189.

[3]M. Clawson and J.L. Knetsch, (1966). Economics of Outdoor Recreation. John Hopkins University Press, Baltimore.

on-site experience; return journey; and recall. The first three phases are similar to the Driver and Tocher model, but Clawson and Knetsch argue that the return journey is distinct from the outward trip in that the anticipation stage is absent. The recall phase is perhaps more important since it reflects the perceptions of the on-site experience which may be different from the physical experience at the time. In addition, recollection often marks the onset of another anticipatory stage. A build-up of recollections results in an assimilation of knowledge of the various opportunities and the associated utilities available to the recreationist.[4] In this model, the role of perception appears in both the anticipation and recall phases.

The final work to be mentioned is by Elson, who places recreation totally within a perceptual construct.[5] His reason lies in the suggestion that relationships drawn between socio-economic factors and recreational trips are subject to many outside, non-controllable factors. The alternative method presented takes into account the cognitive role of the individual, that is, an individual basing his choices on his perceptions or 'action space'. The individual's action space may be conceived as a mental map of the spatial variations of the recreation site attractiveness or utility. Action spaces or perceptions may be affected by the regular activities of living, the

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[4] ibid.

[5] M.J. Elson, (1976). "Activity Spaces and Recreation Spatial Behaviour." Town Planning Review, 47(3), 241-255.

locations of friends and relatives and the media. The degree of knowledge over the action space will vary with type of experience. Elson terms the most structured or known area of the action space, the 'activity space'. He emphasises that the important influences on action and activity space formation are the search and habit phases. The former phase is essentially a learning process wherein an individual tries to discover a site offering the greatest benefits and satisfaction. Once this has been discovered, the habit phase may take over until such a time is reached that the derived satisfaction, for some reason, is reduced. At this point, the search phase will be reiterated. The degree of habit formulation in recreational studies is dependent on the activity. A higher degree of formulation is associated with location-specific activities, such as skiing, while a lower degree of habit formulation is related to car touring and sight-seeing. Elson concludes therefore that the concept of action space (or perception) is relevant in explaining recreation spatial behaviour, in that when perceptual processes are applied to known alternatives, overt behaviour will result based on those processess.

The model constructed in the present study should be regarded within the context of the development in the literature of the use of perception within recreation studies.

A diagrammatic version of the model is shown in Figure 25. The boxes represent behavioural and social variables,

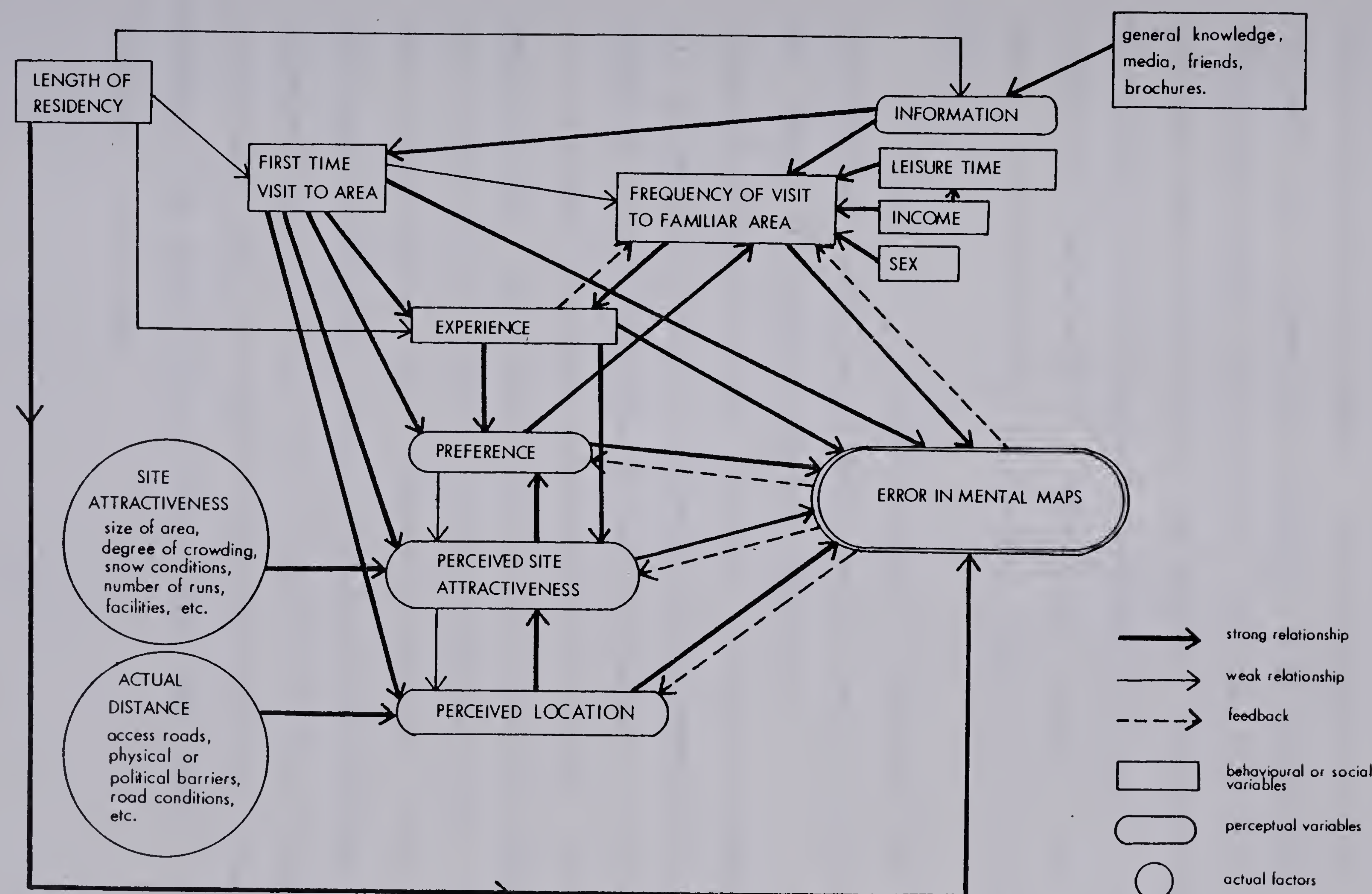

FIG. 25. A Model showing the Interrelationships between a set of Variables and the Error found in Mental Maps.

the circles contain real world information, while the ovals contain perceptual variables. The directional arrows indicate links between the concepts, with the thicker lines indicating stronger relationships, and the thin lines denoting weaker connections. The dashed lines show feedback which results from the perception-behaviour process. Figure 27 puts this model within a behavioural context, but first however, it is necessary to discuss Figure 25 in greater detail.

At the outset, it is necessary to understand that this schema is not inclusive of all possible variables, and in that sense, it is only a partial model of perception-behaviour relationships. It must be remembered at this stage that a partial control was implemented on social variables by only sampling university students. If the model was to be used for other recreational activities, such as camping trips, park visits and so on, it must be used within the stipulation of "given a socially-defined group, then these relationships hold." The model therefore is an oversimplification of the interrelationships between innumerable quantifiable and non-quantifiable variables; it merely takes those variables that were obtained through the medium of the questionnaire, which were then used to test the error in the maps.

7.1 The General Model of Interaction

The basic process of interaction in the model is as follows. There is a series of different sources of information which are filtered or screened through perceptions to become 'known' information to the individual. On the basis of this available knowledge, the individual, prompted by a number of feelings such as motivations, recreational needs, will decide to make a recreational trip either to a familiar resort or to a resort he has not visited before. The number or frequency of visits will also depend upon a skier's available leisure time, income and sex. If the respondent makes a first time trip to a resort, then depending on the outcome of that visit, the action may lay the foundations for the frequency of future visits. The length of residency in a city is a factor in the learning process, and will thereby affect a skier's experience, preference and information of the area. In addition, there is a greater likelihood of a long term resident of a city to have visited the more distant resorts than a newer resident.

It was seen earlier that whether a person has ever visited a resort is probably the one most important variable in the explanation of error. This is reflected in the model, for it can be seen clearly here that a first time visit will affect a skier's experience, his preference system, and his perceptions of the resort's attractiveness and location. The relationships between the latter four variables (experience, preference, perceived attractiveness and perceived location)

are more complex. The use of Figure 26 will help explain how those variables are related.

7.2 The Non-Constrained Model

If a person had no time or cost constraints, he would choose his most preferred resort. In the hypothetical situation shown in Figure 26, the skier's highest preference is to go to a resort that he has never visited before. When he makes his first visit, he not only adds to his overall experience, but his perception of the attractions of the area will also change, which, depending on whether he perceives it as being attractive or not, will affect his preferences. How attractive the resort appears to a particular skier will also depend on his experience and ability. If the resort remains high in his preference, then he will choose to go there again, but this time, it will not be a first visit, but a familiar area. If his original preferences were proven to be mistaken after having made a visit, the skier will re-evaluate his preferences and the resort may not be chosen again as a prime trip destination.

7.3 The Constrained Model

However, in most real world examples, people are constrained in their preferred behaviour by the amount of leisure time available and the costs involved. Therefore if we introduce these modifiers into the model, the skier has

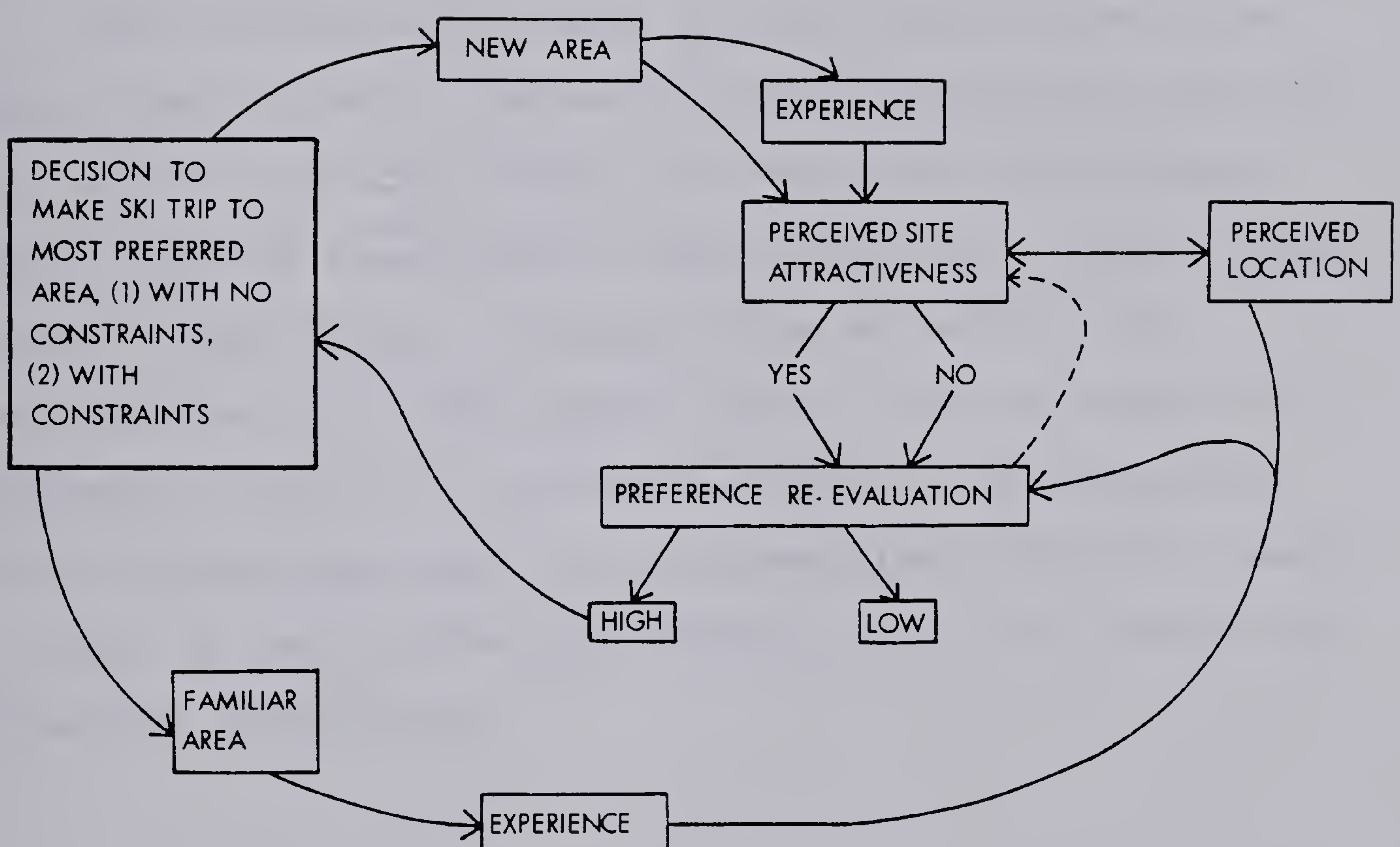

FIG. 26. The Interrelationships between Choice of Destination, Preference, Experience, Perceived Attractiveness and Perceived Distance.

to make the decision of where to go within his current circumstances, that is, a compromise has to be made.

Returning now to the main model (Figure 25), we can see how a strong preference for a resort will promote more visits which in turn all add to the overall experience and ability of the skier. It can also be said that the greater the experience and ability, the more frequent the visits.

Eight variables are shown to contribute to the error found in mental maps. The results showed that while they all help explain the error, some contribute more than others, such as lack of experience or that a skier has never visited a given resort before. Feedback loops are shown; the configuration of an individual's mental map may affect the frequency of visit to a particular resort, the perceived attractiveness and logically, the perceived location. Based on these, as well as having a direct effect, the mental map may affect preferences.

7.4 The Model in a Wider Context

This model should now be placed within a broader context of behaviour, as shown in Figure 27. Again this model is a generalization of more complex and obscure relationships, but it serves to highlight the primary linkages.

We commence with a potential skier who is influenced, among many other things, by motivations, recreational desires, needs and expectations. A combination of these

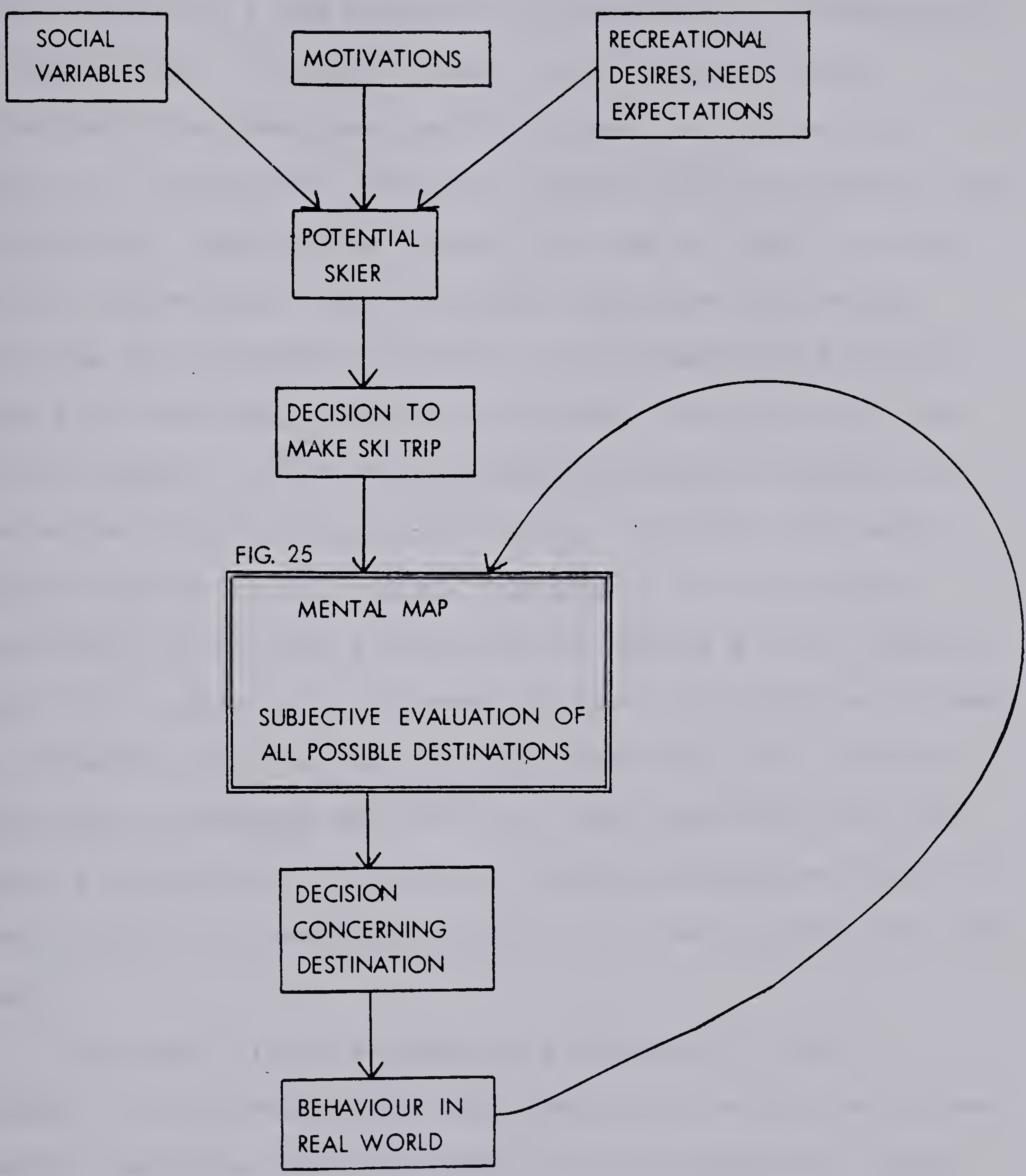

FIG. 27. The Position of Figure 25 in a Wider Behavioural Context.

factors may provoke the skier into making a decision to make a ski trip. The next question is 'where to'? The skier will then evaluate all the possible destinations as projected on his mental map. The mental map, as we have seen is a conscious or unconscious result of such factors as the amount of information, leisure time and money available, his preferences, whether the resort is a new or familiar place, and his experience. Thus the mental map does not merely describe the location of places; it is composed of several layers of awareness related to distance, familiarity, and attractiveness. After the perceptual process or subjective evaluation of all the possibilities, the skier will make a decision where to go, and will generally follow up this decision with the overt behaviour of making a trip. Whether the trip is made to a different or familiar resort will make no difference to the fact that any behaviour will serve as additional knowledge and thereby, make some effect on the skier's perceptions. It must be remembered however that the contribution of knowledge operates at a decreasing rate over time.

This model is as yet merely a structural model. However, it has been shown that consistent relations between certain variables and the amount of error do exist. These results are encouraging, because, given more data and analysis, a model with some predictive powers might be constructed. The variables would first have to be weighted as to their importance in contributing to the error. Then

based on a given set of variables concerning an individual, it would be possible to predict the amount of error in his mental map, and also, to predict an individual's subsequent behaviour.

8. CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

8.1 Aims and Methods

The main aim of the thesis set out in Chapter One was to explain the error found in perceived location maps of skiers in terms of different variables. In addition, it was hoped that the effects of distance decay, perceptual range, distance thresholds and route orientation could be examined.

First, a subject population had to be defined. The sample for this study was taken from university students at the Universities of Alberta and Calgary with the specification that the students interviewed participated in downhill skiing. The interviews consisted of a mapping test in order to elicit the mental maps of the locations of the ski resorts, and a questionnaire, which furnished data from which the variables were derived. The questions were oriented towards obtaining a set of variables, chosen because of their relevance in past research on perception and behaviour. The variables used in the final discussion of the results were 'visits', 'experience', 'frequency of visit', 'length of residency', 'sex', 'perceived attractiveness' and 'preference'. The mental maps, which were derived in the form of points, were analyzed by centrographic techniques (standard distance, mean direction, centroids), and by a bi-dimensional regression program, in an attempt to isolate the error of the perceived locations produced by the different variables.

8.2 Summary of Results

Five different ways of measuring the error in the mental maps were obtained from the analyses. These measures were used to test the hypotheses. The hypotheses were set up to find if there were consistent variations in the amount of error produced by the different variables and whether the locations of the two origin cities in relation to the ski areas had any effect on the error.

The hypotheses tests clearly showed that between-variable differences (that is, the difference in error between experience and inexperience, for example), were more fully supported by the measures than between-city differences. The expectation that Calgary should perceive the locations of the resorts more accurately than Edmonton because of its relative nearness was not borne out in any of the results. The main reason for this was attributed to the concept of perceptual range.

Most of the error could be accounted for by the variables, but nevertheless there was still some unexplained error present. In some cases the amount of unexplained error was quite considerable, (for example, Fernie and Kimberley). This may be due to the fact that these areas are less familiar than the closer Albertan resorts. Indeed, some of the respondents were ignorant of the existence of these two resorts and their perceptions of the locations were therefore random. The less familiar nature of these two British Columbian resorts caused the perceived locations to

be much more widely scattered than for the other resorts, indicating that there was more dissention among the respondents and therefore within-group similarities were not present.

When the variables were divided by city and by below and above average error, a distinct pattern emerged which generally conformed to the original expectations that a person who has made a first time visit to a resort, visits more frequently, and is experienced, will have a more accurate perception than someone who has never visited the resort, goes infrequently, and is inexperienced. In other words, some variables tended to affect the error consistently less than others. Indeed, it was established that the most important variable in determining the error was whether a person has made a first time visit to a resort or not. Two variables were less regular, namely, sex and residency.

The effects of distance decay are not very clear, since the boundaries intervene between the three most distant resorts and the origins. The effect of boundaries on perceptions however was noted and it was found that much of the error is concentrated in the border zones. When the vectors were plotted, it was seen that with the exception of Big Mountain, there was an effect of distance decay on the amount of agreement between the respondents. The effect of route orientation is also apparent in the vector clusters. The only resort whose distance is underestimated (Marmot

Basin), is the only one with a direct route to it; all the other resorts were perceived to be located further away than they actually are, possibly due to the fact that these involve non-direct routes.

Finally, a comparison of preferences and the usually visited area showed that a distance threshold exists in the case of Big Mountain, and to a lesser extent for Lake Louise, indicating that people often have to compromise their preferences in lieu of cost and leisure time considerations.

8.3 Limitations

The fact that not all the error can be explained implies some limitations of the study. These may be at the sampling, mapping and methodological stages. In all sampling, there is sampling 'noise' which is difficult to control unless the sampling is done under laboratory conditions and even then it may be present. The questionnaire may not have solicited enough variable information; that is, there may be some important variables in the formation of error that have not been included. What they would be however, would require a much deeper psychological study.

In any study using mental maps there is doubt as to whether the mental map on paper is the same as the one in the head. Unfortunately, it is hard to prove whether these maps are or are not the same. Therefore, the best the

researcher can do is to find a technique to extract the maps in such a form that they are in context with the aims of the study. In this thesis, there was some question as to whether the resorts are perceived to be locationally related in a person's mental map. If they are, then the method used would have upset the repondents gestalt of the resorts. It was argued that they are not, and therefore the mapping test required the respondents to map the locations of the resorts in relation to the origin city only. As far as the analysis is concerned, the methods used were not exhaustive of all the possible methods available to analyze point data. Perhaps the conclusions would have been different if other centrographic methods had been used. Finally, the unexplained error may be partly as result of the many non-quantifiable factors which arise through the general process of living, implying therefore that we will never be able to fully comprehend what causes the error in mental maps. My contention is that the unexplained error is due to both the fact that there is missing data and also in part to those non-quantifiable factors.

8.4 Future Research

Possible directions for future research that arise out of this thesis are three-fold. Firstly, the mental map design could be applied to many other recreational activities such as camping trips, trips to Provincial Parks, fishing, sailing or canoeing expeditions. All would involve

consideration of the seven main variables used in this thesis. Research has shown that other recreation activities also generate identifiable participant profiles, as did downhill skiing, thereby allowing partial controls to be established at the sampling stage. One area of methodology used in this thesis that might have to be changed if applied in another context, is the mapping procedure. It was pointed out that the isolation of the resorts in peoples' minds did not affect their perceptions because the large distances involved in the study area prevented the resorts to be perceived as being positionally related. In smaller scale studies this could pose a problem and the mapping procedure would have to be modified in some way.

Secondly, the fact that there is still some unexplained error, identifies an area of future concern in which a larger number of variables could be used and strictly controlled to see how they each affect the error. Research directed towards this issue would raise such methodological problems as the form of data collection and the analytic methods used.

The third area for future consideration lies in the expansion of the structural model presented here, to a working predictive model which could be tested against actual behaviour and the derived mental maps.

8.5 Recommendations

As a result of the research for the thesis, a few practical recommendations can be made, based on two sources. First, Question 14 on the questionnaire asked the respondents what they thought would improve the attractiveness of the resorts. The second source is from the results of the thesis.

Many of the improvements suggested by the respondents referred to all the resorts, foremost amongst these being: cheaper lift tickets; expansion of both the ski area and the number of lifts; better advertisement; and there were some suggestions that ski touring (as opposed to cross-country) should be promoted at the resorts. For most of the resorts, more and better day lodges were called for, and also the need for more on- and off-hill accommodation was frequently mentioned, especially in the cases of Lake Louise and Fortress Mountain. Some comments were primarily aimed at particular resorts. Some of the more frequent suggestions are listed below:

Marmot Basin: snow making equipment; better slope grooming; the upgrading of both Highway 16 and the slope access road; apres-ski entertainment; increased lodge size.

Lake Louise: snow-making equipment; increased efficiency of the base area to disperse skiers to the rest of the area; the use of the gondola to transport skiers to the upper slopes in the late season; improved apres-ski entertainment.

Sunshine Village: implement user restrictions at peak

periods and weekends; upgrade the access road and parking lot; a new day lodge.

<u>Fernie</u>: better slope access; a more efficient bus service.

<u>Kimberley</u>: better slope access; better trail marking.

<u>Big Mountain</u>: more advertising.

<u>Fortress Mountain</u>: longer runs; better management.

It was found when discussing the attractivness data, that some factors are most critical to a skiers enjoyment, namely, the area layout, snow conditions, degree of crowding and accessibility. It is the presence of a good area layout, easy slope access and relative lack of crowding that give Lake Louise and Big Mountain very favourable images despite the fact that Lake Louise often has poor snow conditions and Big Mountain is so far away. The above factors may also explain why Sunshine Village and Fortress Mountain have such poor images in skiers' minds because they have poor area layouts, high degrees of crowding and bad access. The only good factor about both of these resorts is that they are both located in the heavy snow belt and therefore receive more snow than any of the other resorts in the study. Therefore if Sunshine and Fortress want to promote a more favourable image, they must upgrade their area layouts by expansion and additional lifts, upgrade their access roads and solve their crowd problems through the process of user restrictions or increased lift capacities.

The mental maps also help to allow recommendations to be made. Fernie and Kimberley are not only distant

physically, but also mentally as people seemed to think of these resorts as being in the vicinity of Kelowna to the west. A better advertising campaign would help to solve this problem as well as making themselves known to a skiing public hitherto ignorant of their existence. On the other hand, Marmot Basin should capitalise on the misconception that it is perceived to be much closer to Edmonton than it really is.

Although the study was not directed towards making practical recommendations, it appears that some are possible. The study's main success however was in the explanation of the error found in the mental maps in terms of a number of behavioural, social and perceptual variables. It is hoped that some of the findings in this thesis will aid in the understanding of the complex interrelationships between perception, behaviour and error in mental maps.

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Number ________ Date ________________ Location ______________

The following questions are concerned with the extent of your ski-ing experience and knowledge of the ski resorts. You may need to keep referring to Card 1.

	M.B.	L.L.	S.V.	F.	K.	B.M.
1. Which of the ski areas on Card 1 have you visited before?						
2. Which of these frequencies (Card 2) best describes the number of visits you usually make to (above).						
3. What is the usual length of your visit to (A & B above)?						
4. Of these ski areas, which do you usually go to?						
5. Now, given no constraints, which of these resorts would you prefer to go to? Rank the areas on a acale from 1 (most preferred) to 6, (least preferred).						
6. From what source (Card 3) did you first hear about each of the ski areas?						

7. What type of transport do you usually use when travelling to ski areas?

Car (own 1
Car (friends) 2
Bus 3
Train 4
Other (please specify) 5 ______________

8. How many years have you been ski-ing regularly?

less than 1 1
1 - 5 2
6 - 10 3
more than 10 4

9. How well do you ski the following types of runs? (Card 4)

TYPE OF RUN	WELL	AVERAGE	POOR	NOT AT ALL
Green (easiest)	1	2	3	4
Blue (more difficult)	1	2	3	4
Black (most difficult)	1	2	3	4

10. Is your equipment: your own 1
borrowed 2
rented 3

11. Who do you usually go ski-ing with? (Check only 1)

Alone 1
With friends 2
With family 3
With family and friends 4
With a club or association 5

12. What do you consider to be the major attraction(s) of the ski areas on Card 1 (if any)?

Marmot Basin ______________
Lake Louise ______________
Sunshine Village ______________
Fernie, B.C. ______________
Kimberley, B.C. ______________
Big Mountain ______________

13. What do you consider to be unattractive about any of the ski areas shown on Card 1?

Marmot Basin ______________
Lake Louise ______________
Sunshine Village ______________
Fernie, B.C. ______________
Kimberley, B.C. ______________
Big Mountain ______________

14. Do you think any changes would increase the attractiveness of any of the sites? (Prompt, if yes, what?

Marmot Basin ______________
Lake Louise ______________
Sunshine Louise ______________
Fernie, B.C. ______________
Kimberley, B.C. ______________
Big Mountain ______________

15. Approximately how long have you been resident in:

Edmonton ________
&/or Calgary ________ <1 1, 2-5 2, 6-10 3, 11-15 4, >15 5.

16. Have you ever lived in any of the ski areas mentioned? YES/NO 1/2
if yes, which? ______________

17. Do you belong to any ski clubs? NO (1)
YES (2) which ______________

18. Sex: M /F 1/2

That's all, Thank you very much for your time.

APPENDIX 1. Coding Methodology used on Questionnaire Data

CARD 1

SKI AREAS

Marmot Basin

Lake Louise

Sunshine Village

Fortress Mountain

Fernie, (Snow Valley), B.C.

Kimberley, B.C.

Big Mountain, Whitefish, Montana.

CARD 2

SKI TRIP FREQUENCY

A) more than 5 times a season

B) 2 - 4 times a season

C) once a year

D) once every few years

CARD 3

INFORMATION SOURCE

A) general experience

B) Brochures, articles, advertisements

C) friends and/or family

D) another source (please specify).

E) have no prior knowledge

CARD 4

ABILITY LEVEL

- well
- average
- poor
- not at all

Appendix 2. Derivation of AA1 scores.

Vertical Drop (m)	1.	300 - 600
	2.	601 - 900
	3.	> 900
Number of Lifts	1.	< 4
	2.	5 - 8
	3.	> 8
Number of Runs	1.	< 20
	2.	20 - 30
	3.	30
Number of Beginner	1.	< 5
	2.	5 - 10
	3.	> 10
Number of Intermediate	1.	< 10
	2.	10 - 15
	3.	> 15
Number of Advanced	1.	< 5
	2.	5 - 10
	3.	> 10
Longest Run (km)	1.	< 5
	2.	5 - 7
	3.	> 7
Ski School	0.	No
	1.	Yes
Ski Shop/rental	0.	No
	1.	Yes

Day Lodges	1.	1
	2.	2
	3.	3 etc.
Lift cost ($)	1.	> 12.50
	2.	10 - 12.50
	3.	< 10.00
Uphill Capacity/hr.	1.	5000
	2.	5000 - 10,000
	3.	10,000
Snow Amount (cm)	1.	< 500
	2.	500 - 1000
	3.	> 1000
Length of season (months)	1.	< 4
	2.	4 - 6
	3.	> 6
Distance to E and C	1.	> 600 km
	2.	300 - 600
	3.	150 - 300
	4.	< 150
Night skiing	0.	No
	1.	Yes
Upper Elevation (m)	1.	< 2000
	2.	2000 - 2500
	3.	> 2500
Lower Elevation (m)	1.	< 1500
	2.	1500 - 2000
	3.	> 2000

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